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FOOD HABITS AND ECONOMIC STATUS OF THE BREWER AND RED-WINGED BLACKBIRDS

By PABLO S. SORIANO

INTRODUCTION

FROM THE economic point of view, birds may be divided into three classes, which are: (1) birds that are destructive throughout their lives, for example, western goshawk and sharp-shinned hawk; (2) birds that feed on crops a part of the year and on insects

the rest of the year, for example, starling and meadowlark; (3) birds that are beneficial all of the time, for example, most hawks and owls.

The Brewer and red-winged blackbirds belong to the second class. Farmers whose crops are visited by flocks of these two kinds of birds complain greatly, and they are convinced that these birds are destructive. On the other hand, some orchardists and farmers whose orchards and crops have been saved from the attacks of insects by these birds feeding on them declare that they are beneficial. Both sides have good arguments to support their views. The question comes up—What is the real economic status of these birds, in the interests of everyone, beneficial or destructive? To answer this question it is desirable to investigate the yearly food of the birds, by means of examination of the stomach contents, and to find out the ratio of the destruction wrought to the benefit they do.

The materials that have been used in this work were collected by deputies of the California Fish and Game Commission and were prepared for long-time preservation by Dr. Harold C. Bryant when he was still connected with the Museum of Vertebrate Zoology, University of California, prior to 1916. The materials were thus already in the laboratory, ready to be worked upon, when this project was undertaken by the author in the summer of 1930. The work has been done in the Museum of Vertebrate Zoology under the guidance of Doctors Jean M. Linsdale and Joseph Grinnell.

GEOGRAPHICAL RANGES

Brewer Blackbird (*Euphagus cyanocephalus*)

Geographical range: Western North America; north to British Columbia, Alberta and Saskatchewan, in the Dominion of Canada; east to Manitoba; Minnesota, Nebraska, Kansas, Oklahoma, and Texas; south to Lower California, and in winter over the Mexican tablelands to Oaxaca. There are two subspecies.

Red-winged Blackbird (*Agelaius phoeniceus*)

Geographical range: Temperate North America; north in the eastern parts of the Dominion of Canada to Ontario, Nova Scotia and Quebec; in the interior to Mackenzie and Keewatin; and on the Pacific coast to southern British Columbia; south to Costa Rica, Central America. There are numerous subspecies.

DESCRIPTIONS

Brewer Blackbird

The Brewer blackbird is smaller than a robin. It is about $7\frac{3}{4}$ to $9\frac{3}{4}$ inches long. The male in summer is glossy greenish black with the neck purplish black. The female is one-fourth smaller. In summer it is brownish gray on the head, neck, and under parts of the body. Head and neck are faintly glossed. Wing and head are more glossed with bluish green. In winter it is paler. The first-winter male is more or less like the adult in color except that the tips of the feathers are grayish brown. Young birds of both sexes are like the female in color, but they are not glossy. The adult male is always distinguished from the female and young by its having a whitish eye; the female's

ye is brownish black. There is no stage in this species of blackbird when the plumage has streaks.

The Brewer blackbirds are common residents in foothills, lowlands, and plains, and they occur in smaller numbers in the mountains. They forage chiefly on open ground. They are tame and fearless in demeanor. A person can ordinarily approach them within a few yards.

When on the ground the birds walk with alternate tread and with consequent side to side movement of the body, and fore and aft movement of the head. They walk easily and gracefully. They are restless creatures. As they continue moving they are looking for food. The birds in the rear, when in a flock, fly up and settle down just ahead of the foremost ones, and this is continued until, when they are all disturbed, the flock flies to a tree or to telephone wires nearby.

Red-winged Blackbird

The male red-winged blackbird is about the same size as the male Brewer blackbird. It is solidly black except for a brilliant red patch at the bend of each wing. The male in winter has the edges of the feathers on the back rusty. The female is decidedly smaller. The plumage of the female, especially in the nesting season, is harsh in comparison with the silky plumage of the male. The top of the head is dark brown with a buff stripe over the crown. The under surface is whitish, heavily streaked with dark brown. The color of young birds is like that of the adult female, the plumage being of heavily streaked pattern. This makes them easily distinguished from young Brewer blackbirds.

These birds are gregarious, most of the time. It is only in breeding season that they are not in flocks, but in pairs, although the pairs are usually in groups even at that season. Their favorite haunts are moist meadows, near streams, ponds, lakes, and marshes; also they often nest in rankly growing hayfields. They are not usually as tame as Brewer blackbirds. Red-winged blackbirds perch on the perpendicular, upright stalks of plants such as rushes along streams, around ponds, and in marshes.

Brief Life Histories of Brewer and Red-winged Blackbirds

The life histories of the Brewer and red-winged blackbirds are in major respects the same. The breeding season takes place in April and May. It is at this time of the year that these birds are in pairs. The courtship of the male Brewer blackbird is not so demonstrative as that of the red-winged blackbird. The nest is usually started within a week after mating and it takes the birds about a week to finish a nest.

The Brewer blackbirds never nest in large colonies. They usually build their nests in bushes or small trees at different heights from the ground, but sometimes also on the ground itself. The nests when placed in trees and bushes are quite bulky, consisting of platforms of coarse sticks supporting a deep cup composed of weed and grass stalks, shreds of bark, rootless dry grasses, mosses, and mud, the latter when dry serving as a binding cement. The nests built on the ground are well built and the materials used are mostly moist when gathered. The nest is generally about six inches in outer diameter, four inches in inner diameter, three inches in outer depth, and two and one-half inches in inner depth.

The red-winged blackbirds usually build their nests among the dense vegetation in marshes; sometimes the nests are in rank weed-patches or even in standing grain. The size of the nest is practically the same as of the nest of the Brewer blackbird. Mud, however, is not used by the red-wing. Sometimes red-winged blackbirds' nests are found in the forks of willow, alder or elder bushes. They nest in colonies.

The number of eggs that the Brewer blackbird lays is more, on an average, than that of the red-winged blackbird. The number of eggs in the former is usually five, while that of the red-winged blackbird is usually but three or four. Eggs are deposited daily until the set is completed. Incubation takes about two weeks.

The male Brewer blackbird is very helpful to his mate during breeding season. He helps in the construction of the nest, in the protection of the eggs, and in the protection and care of the young. Both male and female greatly protest at the approach of any animal to their nest and sometimes the neighbors help them in driving away the intruder (Grinnell and Storer, *Animal Life in the Yosemite*, 1924, p. 414). Incubation is done only by the female. The birds of a pair are usually seen walking side by side with swinging gait searching for food for themselves as well as for the young.

The male of the red-winged blackbird, as a partner, is not as helpful as the male Brewer blackbird. He does not help much in the building of the nest or in feeding and caring for the young. This is due, perhaps, to his polygamous habits. However, he defends the nests and young in the colony of red-wings against any intruder. Yet in nest protection, the Brewer blackbird is the more aggressive.

In winter red-winged blackbirds occur in great flocks. These birds, in parts of their general range, migrate twice a year—in the spring and in the fall. Spring migration usually takes place in March and April. At this time they are in flocks going to their breeding places, where they nest in April and May. In 16 days after hatching, the young birds leave the nests and join in flocks by themselves. In October and November they in company with the old birds migrate again to warmer places or to places where food is more plentiful. During the two migrations, when they are often in flocks of enormous numbers, is the time they do most damage to the crops. In both migrations the flights are usually made in the evening and early morning.

These two species of birds each have distinctive calls and notes. The song of the male Brewer blackbird is a wheezy *tseur* or *tshee*. Both the male and female utter a harsh *tshick* and this is uttered by them in flying, foraging or perching. The male red-winged blackbird gives a throaty *long-leur-lee*. Both sexes, adult or young, when excited give a sharp *chack*. The male whistles and scolds when an intruder approaches the nest.

BASIS FOR INFORMATION

A good and reliable basis for information as to the real economic status of birds is field observation supplemented by stomach examination (Bryant, *Univ. Calif. Publ. Zool.*, 11, 1914, p. 456). In field observation, it is easy to see the destruction or benefit the birds do in the

rain fields and orchards, especially when they are in great flocks, which is hard to tell in the examination of stomach contents. It is the vividness of the impression that sometimes counts. In field observation, it can be also observed whether they take newly sown seeds or uncovered grains, which can not be told in laboratory examination. In field observation it is sometimes more easy to identify the insects as well as the vegetable food eaten, for the items are still complete.

In this work field observation was not done, for the specimens that have been worked upon were already assembled. However, the result of stomach examination gives a fair indication of economic status, for whatever objects are found in the stomachs are definitely what the birds get in feeding.

METHOD USED IN ESTIMATING THE QUANTITY OF FOOD IN A BIRD'S STOMACH

There are three methods generally used in estimating the quantity of food in a bird's stomach. They are: (1) The articles found may be weighed; (2) they may be estimated by the volume; (3) they may be counted (Bryant, *op. cit.*, p. 440).

The weight method is more or less neglected because it is not practicable. Besides, the weight of vegetable food or animal food does not indicate the degree of injury or benefit that the bird gives.

The percentage by volume has been used in this work only in the estimation of the space the vegetable food or animal food or pebbles occupies in the stomach, for this shows the ratio which each bears to the others. The presence of one limits the presence of the others, depending upon the size. For example, the greater the volume of wheat the less the volume of animal matter or pebbles, taking for granted that the stomach is full.

The degree of injury or benefit that an animal does depends directly on the total number of injurious organisms that it destroys. Having this in mind the numerical method is advisable. This method has been followed in taking the percentage of the different kinds of foods taken in connection with this work.

The number is determined by counting. The number of the paired mandibles of grasshoppers showed the number of grasshoppers taken. The number of snouts of beetles showed the number of weevils taken. The number of paired elytra showed the number of beetles taken.

METHODS OF IDENTIFICATION

The stomach is opened lengthwise at the side and carefully cut so that the materials inside are not destroyed. The contents are put in a white basin with a little water in it, so that it is easy to separate the vegetable food from the animal food, as well as from the pebbles. After they are separated they are piled up—one pile for vegetable food, one pile for insect food, and one pile for pebbles; and the ratio of each volume to the others is taken. After the ratio is taken, which perhaps is not arithmetically exact, the different kinds of food are separated and each kind is counted and identified. The ratio and the number are recorded on a card as shown below. The number of items of each kind found and their condition are recorded under "contents,"

No. -----	Date -----	Time -----
Locality -----		
Type of vegetation -----	Collector -----	
Name of species -----		
Condition of stomach -----		
Animal matter, no. of items -----	Percentage -----	
Number of items of vegetable matter -----	Percentage -----	
Number of pebbles -----	Percentage -----	
Contents -----		

To identify the kinds of food found in the stomach is a hard task. If the grains, seeds, or insects found in the stomach are not yet at all digested, to identify them is not so hard; but when they are partly digested, then it becomes difficult to identify them with certainty.

To facilitate the identification, recourse is had to a collection of insects, seeds, and grains with which to compare what has been found in the stomach. The insects, the seeds, and the grains are put in vials (one vial to each kind) and are dried out for identification. In some cases the insects are put in water, to float, so that external appendages can be made loose for examination.

The insect collection of the Entomology Department of the University of California, in the Agricultural Hall, and the seed collections made by Dr. H. C. Bryant were used for comparison in connection with this work. In the examinations a hand lens in addition to a binocular microscope was used.

THE GROUPING OF COUNTIES

All the counties where the 500 birds examined were taken are arranged in three groups. Each group includes those counties that are near to each other, and this means that the season of planting and harvesting is almost the same, as well as the vegetation and crops raised, within each group.

Group I includes the following counties:

1. Siskiyou
2. Humboldt
3. Mendocino
4. Tehama

Group II includes the following counties:

1. Sonoma
2. Sutter
3. Nevada
4. Calaveras
5. Alameda
6. San Joaquin
7. Stanislaus

Group III includes the following counties:

1. Fresno
2. Kern
3. Riverside
4. Ventura

FOOD HABITS OF THE BREWER BLACKBIRDS

Group I

The examination of the 125 stomachs of Brewer blackbirds showed that 38 per cent of the annual food was animal matter. It was more than 50 per cent of the food from February to July except in April when it was only 9 per cent. The maximum was taken in May, June, and July, the figures for which were 70, 100, and 81 per cent, respectively. In April, although the vegetable food was 91 per cent of the whole food, most of the items were weed seeds, which made up 75 per cent of the total content. Animal food was lowest in December, when it was only 3 per cent of the food.

Animal Food

Insects

Out of the animal food which numbered 1135 items only one was an arachnid. Practically all the animals taken were insects. The monthly food percentages are: January, 49; February, 61; March, 55; April, 9; May, 70; June, 100; July, 81; August, 16; September, 11; October, 44; November, 5; December, 3. (See table 1.)

In winter the percentage of insect food was low due to the fact that insects hibernate. The insects mostly taken were the ones found in their hibernating places, and the bodies of the dead ones that were preserved by the winter cold—but as early as February, insect food was already 61 per cent and most of the destructive insects were caterpillars, locusts and click beetles. These insects were the destructive ones, most liable to be the prey of these birds because they hibernate on the ground and these birds are, most of the time, ground feeders.

Coleoptera—Beetles

Out of the 38 per cent insect food 15 per cent were beetles. These beetles belonged to many families but most of them belonged to these families: weevil family (Curculionidae), 3 per cent; click beetle family (Elateridae), 2 per cent; June beetle family (Scarabaeidae), leaf beetle family (Chrysomelidae), ground beetle family (Carabidae), carrion beetle family (Silphidae), 1 per cent each.

Weevils were the beetles taken in greatest number. By the destruction of these insects, these birds rendered a great help to the farmers in particular and to the people in general, for these beetles are destructive. In January, weevils were 15 per cent of the food contents of the 10 stomachs of these birds examined, and 4 out of the 10 stomachs contained them (see table 3). In March, they were 11 per cent of the food contents of the 22 stomachs examined, being found in 6 stomachs out of the 22. The highest percentage of this kind of beetle in the food contents of 1 stomach was 62. In April, it was 3 per cent of the food contents of 21 stomachs examined, and it was found in 6 stomachs out of the 21. The highest percentage of this beetle in the food contents of 1 stomach was 77. In May, it was 10 per cent of the food contents of the 11 stomachs examined, and it was found in 1 stomach. It was 59 per cent in the food contents of that stomach. In February and November weevils were also taken, but the percentages were small. Weevils were the highest in percentage among all the beetles taken by the 125 birds examined. These birds then are effective in the destruction of weevils.

The click beetle family was the second highest in percentage among all the beetles found in the 125 stomachs. They were taken mostly in February for they were 7 per cent of the food contents of the 20 stomachs examined. Click beetles were found in 7 stomachs. One stomach was nearly filled with this kind of beetle, for the percentage was 94. In March, this kind of beetle was 1 per cent of the food contents of the 22 stomachs examined, being found in 2 stomachs. In May it was 2 per cent of the food contents of the 11 stomachs examined and it was found in 1 stomach only. This kind of beetle being the second highest in percentage among the beetles in the food contents of the 125 stomachs examined, shows Brewer blackbirds to be effective in destroying these harmful beetles.

June beetles, leaf beetles, ground beetles and carrion beetles were all the same in percentage in the food contents of the 125 Brewer blackbirds' stomachs examined. But in the number of items the June beetle stood foremost. It was taken mostly in March, April and June. It was taken mostly in June when it was 45 per cent of the contents of the 9 stomachs examined. It was found in 3 stomachs and one of these 3 contained 100 per cent June beetles. These June beetles (adults), although they are not as destructive as the larvae, do great damage to the plants by feeding on the leaves. The larvae are more destructive than the adults because they are root feeders and their presence is recognized only when the plants attacked become sickly. The best control is then directed to the adults, for the adults are exposed and the destruction of an adult means the destruction of many larvae. These Brewer blackbirds are a great help to the farmers and growers because they destroy the adults of this insect which is one of the most important beetles in their diet. The leaf beetles are taken mostly in January and May. In January, they were 11 per cent of the food contents of the 10 stomachs examined. In May, they were 13 per cent of the food contents of the 11 stomachs examined and were found in 3 stomachs. These beetles constituted the only food contents of 1 stomach. Ground beetles are taken mostly in January, March, May and June. In January, they were 1 per cent of the food contents of 10 stomachs, being found in 4 stomachs. In March, they were 2 per cent of the food contents of the 22 stomachs examined. They were found in only 3 stomachs. In May, they made up 3 per cent of the food contents of the 11 stomachs examined, being found in 1 stomach. In June, this beetle was 16 per cent of the food contents of the 9 stomachs examined. It was found in only 4 stomachs. It was also taken in February but the percentage was low. The ground beetles are both predacious and vegetable feeders. Economically they are not so important to deal with, because the vegetarians are quite balanced by the predacious ones. The carrion beetles were mostly taken in February, May, and June. In May, this group made up 23 per cent of the food contents of the 21 stomachs examined. It was in this month that it was taken most often. In June, it was 6 per cent of the food contents of the 9 stomachs examined. It was found in 1 stomach, in which it was the only food contained. These beetles are not important economically, for some of them feed on dead vegetable matter. The vegetarians are not a great menace to the crops and they are not important.

The other beetles taken were the darkling beetles, rove beetles and others but their numbers are so small that they do not have a great effect economically.

Orthoptera—Locusts, Grasshoppers, Crickets

Locusts were 1 per cent of the food contents of the 125 stomachs examined. Locusts were taken mostly in March, July, August, September, October and November. In March they were about one-half per cent of the food contents of the 22 stomachs examined. In July they were 73 per cent of the food contents of the 2 stomachs examined. They were found in 2 stomachs (see table 3) and comprised 73 per cent of the food contents. They were taken most often in this month. In August, this group was 15 per cent of the food contents of 2 stomachs. It was the sole food content of 1 stomach. In September, it was about 1 per cent of the food contents of 12 stomachs. In October, it was 13 per cent of the food contents of the 2 stomachs. In November, it was 1 per cent of the food contents of 9 stomachs.

Locusts are taken almost every month. Locusts are destructive to plants on account of their feeding habits. They are great eaters and they eat every leaf that they come to. These birds then may be a great help to the farmers whose crops are sometimes the victims of these voracious plant feeders.

Lepidoptera—Moths and Butterflies

Caterpillars were the ones mostly taken. They were 1 per cent of the food contents of the 125 stomachs. They were taken mostly in January, February, March, April and May. In January they were 1 per cent of the food contents of the 10 stomachs. In February this group was 6 per cent of the food contents of the 20 stomachs; in March, it was 1 per cent of the food contents of the 22 stomachs; in April, it was about 1 per cent of the food contents of the 27 stomachs. It was in May that it was taken the most, for it is the time of the year that caterpillars are abundant. Caterpillars are foliage feeders. They are such great feeders that they can easily defoliate a big tree, of course depending upon the number present. Brewer blackbirds are a great help to the farmers and growers by destroying these destructive larvae.

Hymenoptera

In the order Hymenoptera, the ants, family Formicidae, were the ones mostly taken. They comprised 18 per cent of the whole food contents of the 125 stomachs. These insects live in colonies in such great numbers that no matter how much is taken their number seems not to be reduced. Economically these insects are not so important except from the public health point of view. But these ants taken were not house invaders, so we are not affected by them. They were taken mostly in February, March, April and September. In February, they were taken the most, for they were 44 per cent of the food contents of the 20 stomachs examined. In March, the group was 35 per cent of the food contents of 22 stomachs, and in April, it was 27 per cent of the food contents of the 21 stomachs.

Miscellaneous Insects

Diptera, mostly larvae, were taken. They were 1 per cent of the food contents of the 125 stomachs examined. The larvae taken were the ones found in manure.

Hemiptera were not important as food for these birds. Only 1 hemipterous insect, family Scutelleridae, was taken and it was taken in March.

Chilopoda and Arachnida

Only one centipede and 1 spider were taken. The former was taken in February and the latter was taken in June.

Vegetable Food

Vegetable food was 62 per cent of the food contents of the 125 stomachs examined. The monthly percentages of the vegetable food were: January, 51; February, 39; March, 45; April, 91; May, 30; June, 0; July, 19; August, 84; September, 89; October, 56; November, 95; December, 97. (See table 1.)

Cereals

Wheat Grains

Among the vegetable food, grains of wheat ranked the highest. It was 30 per cent of the food found in the 125 stomachs examined. In January, it was 26 per cent of the food contents of the 10 stomachs examined. Only 1 of these 10 stomachs did not contain grains of wheat (see table 4). The highest percentage of grains of wheat in a stomach was 84. In February, it was 27 per cent of the food contents of the 20 stomachs. It was found in 14 stomachs. In March, it was 29 per cent of the food contents of the 22 stomachs. It was found in 12 stomachs and the highest percentage in a stomach was 100. In April, it was 16 per cent of the food contents of the 21 stomachs. It was found in 14 stomachs and the highest percentage in a stomach was 20. In May, it was 7 per cent of the food contents of the 11 stomachs. It was found in five stomachs and the highest percentage in one stomach was 85. In June no vegetable food was found in 9 stomachs. In July, practically no vegetable food was found. In August it was 84 per cent of the food found in 2 stomachs. Only 1 of the stomachs contained it and it was the only vegetable food. In September, it was 56 per cent of the food contents of the 12 stomachs. It was found in 9 stomachs, and the highest percentage in a stomach was 94. In October it was 39 per cent of the food found in the 2 stomachs. It was found in both of them. In November, it was 82 per cent of the food found in 9 stomachs. It was found in 6 stomachs and 1 stomach contained only wheat grains as the food contents. In December, it was 72 per cent of the food contents of the 5 stomachs. Only 1 stomach did not contain it, and another stomach did not contain any vegetable food except grains of wheat.

In winter months the percentages of wheat grains taken were high, due to the fact that the insects were then hibernating. Although the percentages were high these grains were considered waste grains and economically they were of no importance. In February and March the percentages of wheat grains taken in northern California were 27 and 29 respectively. Planting of cereals takes place in these

nonths. Taking for granted that these grains were the sown seeds uncovered, the damage the birds did was not great because the percentages were not high. During harvest season, which takes place in June and July, the percentages were very low due to the fact that insects were abundant at this time, especially the June beetles. This shows that these birds are more insectivorous in habit than vegetarian. In August the percentage was high but these grains were considered waste grains, for harvest was already finished.

Barley and Oat Grains

Barley grain was taken only in the months of March and April. In March it was 2 per cent of the food contents of 22 stomachs. In April it was only 1 per cent of the food contents of 21 stomachs.

Oat grain was taken only in April and May. In April it was about 1 per cent of the food contents of 21 stomachs. In May it was 2 per cent of the food contents of 11 stomachs.

Both of these cereals were taken in such a very small percentage that economically they are not important.

Miscellaneous Vegetable Food

In the 125 stomachs 19 per cent of the food contents was red-stem ilaree (*Erodium cicutarium*). It was taken in January, February, March, April, September and October. It was mostly taken in April and September, when it was 73 and 31 per cent, respectively, of the food contents of the 21 and 12 stomachs. Rough pigweed (*Amaranthus retroflexus*) was 3 per cent and was taken in January, February, and March. Common knotweed (*Polygonum lapathifolium*) was about 3 per cent and taken in January, February, March, November and December. Common chickweed (*Stellaria media*) was 2 per cent and taken in February and November. Water grass (*Echinochloa crus-galli*) was taken in January and September. The percentage was so small as not to be significant.

Group II

Animal Food

In the yearly food contents of the 90 stomachs of the Brewer blackbirds examined, 12 per cent was animal food, consisting almost wholly of insects. The monthly percentages of insect food were: January, 14; February, 11; March, 22; April, 14; May, 35; June, 100; July, 100; September, 1; November, 0; December, 19. (See table 1).

No stomachs taken in August and October were examined.

Coleoptera—Beetles

Out of the 12 per cent insect food, 6 per cent was Coleoptera (beetles). These beetles belonged to many different families and the most important families were: leaf beetle family (Chrysomelidae), weevil family (Curculionidae), June beetle family (Scarabaeidae), rove beetle family (Staphylinidae), carrion beetle family (Silphidae), barkling ground beetle family (Tenebrionidae), ground beetle family (Carabidae).

The leaf beetle family was taken more often than other kinds of beetles. It was taken in January, February, March, April, July and December. It was taken mostly in January and March. In January

it was 19 per cent of the food contents in the 19 stomachs examined. It was found in 3 stomachs (see table 3) and the highest percentage in a stomach was 69. In February it was 1 per cent of the food contents in 9 stomachs. In March it was 1 per cent of the food contents of 18 stomachs. In April it was 8 per cent of the food contents of 12 stomachs. In July it was 2 per cent of the food contents of 7 stomachs. In December it was 8 per cent of the food contents of 6 stomachs.

A leaf beetle is a destructive insect to plants. Birds destroying this insect may be a help to the farmers and growers.

The weevil group was taken mostly in January, February, and March. In January it was 3 per cent of the food contents of the 19 stomachs examined. It was found in 3 stomachs and the highest percentage in a stomach was 35. In February it was 1 per cent of the food contents of 9 stomachs. In March it was 1 per cent of the food contents of 18 stomachs. It was found in 3 stomachs and the food content of 1 stomach was solely weevil.

A weevil is a destructive insect, and birds destroying it may be doing a great help to the farmers and growers.

The June beetle family was taken mostly in April and July. In April it was 10 per cent of the food contents of 12 stomachs. In July it was 2 per cent of the contents of 7 stomachs. Both the adults and larvae of this family are destructive to plants and it is always desirable that they be killed.

The darkling ground beetle family was taken mostly in January, February, March, April, May, July and September. It was the most widely taken among the beetles. The highest percentages were taken in May and July. In May it was 5 per cent of the food contents of the 3 stomachs examined, and it was 4 per cent of the food contents of the 7 stomachs in July. The members of the darkling ground beetle family are both predacious and vegetarian.

The click beetle family was taken in February, March, April and May. It was mostly taken in March and in May. In March it was 1 per cent of the food contents of the 18 stomachs examined. In May it was 2 per cent of the food contents of 3 stomachs. This family of beetle is destructive and it is always advisable that they be destroyed.

The other families of beetle—rove beetle (*Staphylinidae*), carrion beetle (*Silphidae*), ground beetle (*Carabidae*)—taken were both predacious and vegetarian. In some cases predacious ones are beneficial, but in some cases they are destructive because they feed on other predacious insects that feed on destructive insects. Others, which are vegetarian, are destructive to our crops. As a food of these Brewer blackbirds, their percentages are so small that economically, in either direction, they are not important.

Lepidoptera—Caterpillars

Caterpillars made up 6 per cent of the yearly food contents of the 90 stomachs of Brewer blackbirds examined. They were taken mostly in January, February, March, and June. Highest percentages were taken in February, March and June. In February, the group was 2 per cent of the food contents of 9 stomachs. In March, it was 2 per cent of the food contents of 18 stomachs. In June, it was 66 per cent of the food contents of the only stomach examined.

Orthoptera—Locusts, Crickets, Grasshoppers

The locust group was 1 per cent of the yearly food contents of the 10 stomachs examined. It was taken mostly in March, May, and July. In March, it was 2 per cent of the food contents of the 18 stomachs examined. In May, it was 5 per cent of the food contents of the 3 stomachs examined. In July, it was 41 per cent of the food contents of the 7 stomachs.

Crickets were taken in January and March. In January, they were 4 per cent of the food contents of the 19 stomachs examined. In March, they made up less than 1 per cent of the contents of 9 stomachs.

Homoptera—Aphids and Leafhoppers

In March, aphids were 3 per cent of the food contents of the 18 stomachs examined. In April, leafhoppers were 1 per cent of the food contents of the 12 stomachs examined. These two insects are destructive to plants, especially to crops. Their destruction helps the farmers and growers.

Miscellaneous Insect Food

Diptera were taken in January and March. They were taken mostly in March, for the percentage of the food contents of the 18 stomachs examined was 7. Hemiptera were taken in February, March and July—most of them belonging to the family Miridae. It was mostly taken in July, for it was 14 per cent of the food contents of the 7 stomachs examined. Among the Hymenoptera, the family Formicidae was taken the most. It was taken in February, March and December. It was taken most often in December, when it was 15 per cent of the food contents of the 6 stomachs examined.

Chilopoda and Arachnida

Chilopods were taken in March, although only 3 in number.

Arachnids were taken in February, March and April. Only 1 arachnid was taken in each month.

Vegetable Food

In the yearly food (average of ten months) of the 90 stomachs examined, 68 per cent was vegetable food. The monthly percentages of vegetable food were: January, 86; February, 89; March, 78; April, 86; May, 65; June, 0; July, 0; September, 99; November, 100; December, 1. No stomachs were examined for August and October. (See table 1.)

CEREALS**Wheat**

Of the 68 per cent vegetable food, 20 per cent was wheat grain. Wheat grains were taken in the months of January, February, March, April, November, and December. They were taken thus mostly in the winter months. In January, wheat grain was 63 per cent of the food contents of the 19 stomachs examined. It was found in 18 stomachs (see table 4) and the highest percentage in a stomach was 100. In February, it was 52 per cent of the food contents of the 9 stomachs. The highest percentage in a stomach was 96. In March, it was 8 per cent of the food contents of the 18 stomachs. It was found in 4 stomachs, and the highest percentage in a stomach was 100. In April,

it was 9 per cent of the food contents of the 12 stomachs. It was found in 2 stomachs and the highest percentage in a stomach was 93. In November, it was 16 per cent of the food contents of the 8 stomachs examined. It was found in 4 stomachs, and the highest percentage in a stomach was 95. In December, it was 51 per cent of the food content of the 6 stomachs examined. It was found in all 6 stomachs and the highest percentage in a stomach was 100.

Oat Grain

Oat grain was taken in February, April and September. In February, it was 2 per cent of the food contents of the 9 stomachs examined. In April, it was 14 per cent of the food contents of the 12 stomachs examined. In September, it was taken most often. It was 30 per cent of the food contents of the 7 stomachs examined. It was found in 4 stomachs and the highest percentage in a stomach was 95.

Sorghum Grain

Sorghum halepensis was taken in January and March. The percentages were so small that they are of no importance at all.

Cereals were taken mostly when there were no insects. In June and July, the harvest time for wheat and oats, none of these cereals was taken, because at these times insects were abundant, showing that these birds are more insectivorous than vegetarian. Most of the cereals taken in November, December, January, and February were taken near barns and stables and some from the newly sown seeds uncovered. Such being the case, these birds during planting seasons are not destructive, and the destruction they do is small in comparison with the benefit they give during the rest of the year.

The percentage of oat grain taken was so small that it has no economic bearing.

Miscellaneous Vegetable Food

In the 90 stomachs examined, 29 per cent of the food contents was red-stem filaree (*Erodium cicutarium*). It was taken mostly in January, February, March, April, May, September, and November. *Amaranthus blitoides* was 4 per cent; common knotweed, 3 per cent; *Panicum*, 23 per cent; rough pigweed, 1 per cent; *Amsinckia*, 1 per cent. Most of these were taken in the months when insects were few.

Seeds of berries of the genus *Ribes* were taken in May and September. They were so few that economically they are of no importance.

Group III

Animal Food

In the yearly food contents of the 70 stomachs of Brewer blackbirds examined, 9 per cent was animal food, all insects. The monthly percentages of the insect food were: January, 2.4; February, 0.9; April, 75; May, 74; June, 83; October, 20; November, 8; December, 0. No stomachs were examined in March, July, August and September. (See table 1.)

Coleoptera—Beetles

Out of the 9 per cent insect food, 3 per cent was Coleoptera (beetles). These beetles belonged to several different families and the most important families were: leaf beetle family (Chrysomelidae),

ground beetle family (Carabidae), darkling ground beetle family (Tenebrionidae), rove beetle family (Staphylinidae), weevil family (Curculionidae), June beetle family (Scarabaeidae).

In the yearly food contents of the 70 stomachs examined, every family of beetle was less than 1 per cent. Most of the beetles taken belonged to the leaf beetle family and they were taken in January, May, October and November and the number of items taken were three, ten, two and two, respectively. The second in number was the ground beetle family. They were taken in January, April, May and June. The number of items in each month was: January, 1; April, 2; May, 7; June, 1. The third was the darkling ground beetle family. They were taken in February, April, May, June and October and the numbers of items taken in each month were one, six, one, two and three. The fourth was the rove beetle family. They were taken in April and May. The fifth was the weevil family. They were taken in February, April, May and November and the numbers of items taken in each month were one, three, one and two, respectively. The sixth was the June beetle family. They were taken in January, April and December, and the number of items taken in each month was two, two and three respectively. The number of stomachs examined in each month was: January, 13; February, 12; April, 4; May, 3; June, 4; October, 12; November, 11; December, 11. In spite of the fact that the numbers of stomachs examined in April, May, and June were few, more insects than seeds were taken. This is due to the abundance of insects in these months.

Miscellaneous Insect Food

Diptera were taken in January, April, June and November. They were taken mostly in June and November and the numbers of items taken were 31 and 29 respectively.

Hymenoptera were taken in January, October, and November. Most of them belong to the ant family (Formicidae). In January 2 Hymenoptera were taken; in October, 37; in November, 3.

Orthoptera were taken in June and October. In June, 6 locusts (Locustidae) and 2 crickets (Gryllidae) were taken. In October, only 1 locust (Locustidae) was taken.

Vegetable Food

Vegetable food was 91 per cent of the food contents of the 70 stomachs of Brewer blackbird examined. The monthly percentages were: January, 97.6; February, 99.1; April, 25; May, 26; June, 17; October, 80; November, 92; December, 100. (See table 1.)

Cereals

Wheat and Oats

Among the vegetable food items, wheat grain ranked the highest. It was 26 per cent of the food contents of the 70 stomachs examined. In January it was 32 per cent of the food contents of the 13 stomachs examined. It was found in 10 stomachs (see table 4), and the highest percentage in a stomach was 100. In February, it was 59 per cent of the food contents of the 12 stomachs. It was found in all the 12 stomachs and the highest percentage in a stomach was 100. In April,

it was 25 per cent of the food contents of the 4 stomachs. In June, it was 12 per cent of the food contents of the 4 stomachs. In October, it was 59 per cent of the food contents of the 12 stomachs. In November, it was 12 per cent of the food contents of the 11 stomachs. In December, it was 2 per cent of the food contents of the 11 stomachs.

The highest percentages of wheat grain were taken in February just after planting and in September just before planting. These grains then were probably waste grains. The grains of wheat taken during planting were few and the chances are that these grains were taken, near stables and barns. Only 6 grains of wheat were taken in June—the harvest month.

Oat grain was taken in May, just before harvest. It was 36 per cent of food contents of the 3 stomachs examined.

Sorghum

Sorghum was taken in January, June, October, November and December. It was 2 per cent of the food contents of the 70 stomachs examined. Most of these grains were the wild corn (*Sorghum halepensis*). The highest percentage was taken in October. It was 15 per cent of the food contents of the 12 stomachs examined. Although it was taken during harvest time the percentage was small so that the destruction probably would not be felt.

Hordeum—Wild Barley

Hordeum was taken in January, October, November and December. It was taken mostly in December and January. In December, it was 21 per cent of the food contents of the 11 stomachs examined. In January, it was 10 per cent of the food contents of the 13 stomachs examined. For the rest, the percentages were very low.

Miscellaneous Vegetable Food

Amaranthus blitoides made up 5 per cent of the food found in the 70 stomachs examined. It was taken only in November. Knotweed (*Polygonum*) was 11 per cent, and was taken in January, February, October, November and December. Red-stem filaree (*Erodium cicutarium*) was 1 per cent and was taken in January, February, June, October and November. *Phalaris* was 1 per cent and taken in January, February and November. Rough pigweed was 1 per cent and taken in January, February and December. Foxtail grass, *Amsinckia* and *Ribes* were so few that economically they are of no importance.

FOOD HABITS OF THE RED-WINGED BLACKBIRDS

Group I

Animal Food

In the yearly food contents of the 109 stomachs of red-winged blackbirds examined, 13 per cent consisted of animal food and all of these animals were insects. The monthly percentages of insect food were: January, 15; February, 2; March, 13; April, 25; May, 11; June, 16; July, 100; August, 25; September, 8; October, 11; November, 6; December, 1.

Coleoptera—Beetles

Out of the 13 per cent insect food, 8 per cent was Coleoptera—beetles. These beetles belong to different families and the most important families were: weevil family (Curculionidae), rove beetle family (Staphylinidae), darkling ground beetle family (Tenebrionidae), ground beetle family (Carabidae), click beetle family (Elateridae), and leaf beetle family (Chrysomelidae).

The weevil group was taken the most and it was 2 per cent of the food contents of the 109 stomachs. It was taken mostly in March, May and June. In March, it was 4 per cent of the food contents of ten stomachs examined. It was found in eight stomachs (see table 5), and the highest percentage in a stomach was 50. In May, it was 3 per cent of the food contents of 20 stomachs. It was found in four stomachs and the highest percentage in a stomach was 76. It was taken the most often in June, when it was 8 per cent of the food contents of 23 stomachs. It was found in 13 stomachs and the highest percentage in a stomach was 50. The percentages of those taken in August, September and November were so low as not to be worth considering.

The rove beetle family was 1 per cent of the food contents of the 109 stomachs. It was taken mostly in April, June and August. In April, it was 6 per cent of the food contents of the 15 stomachs. In June, it was 2 per cent of the food contents of 23 stomachs. In August, it was 2 per cent of the food contents of ten stomachs.

Darkling ground beetle family was taken mostly in April and June. In April, it was 3 per cent of the food contents of the 15 stomachs. In June, it was 2 per cent of the food contents of the 23 stomachs. Economically this family of beetles is not important.

Ground beetle family was mostly taken in April, May and August. In April, it was 4 per cent of the food contents of the 15 stomachs. In May, it was 1 per cent of the food contents of the 20 stomachs. In August, it was 2 per cent of the food contents of the ten stomachs. Having the same status as the darkling ground beetle family, this family is not important.

Click beetles were taken mostly in January. This group was 2 per cent of the food contents of the four stomachs. These beetles are destructive.

Leaf beetles were taken mostly in October. They were 1 per cent of the food contents of the 15 stomachs. This kind of beetle is destructive.

Lepidoptera—Caterpillars

Caterpillars were 1.6 per cent of the yearly food contents of the 109 stomachs. They were taken mostly in January, April, May, June and October. In January, they were 9 per cent of the food contents of the four stomachs examined. In April, they were 5 per cent of the food contents of the 15 stomachs. In May, they were 3 per cent of the food contents of the 20 stomachs. In June, they were 2 per cent of the food contents of the 23 stomachs. In November, they were 4 per cent of the food contents of the 11 stomachs. These insects are destructive insects due to their feeding habits (vegetarian) and their elimination locally is desirable.

Orthoptera—Locusts, Crickets, and Cockroaches

The locust group was taken in June, July, and August. It was taken mostly in July and August. In July, it was 100 per cent of the food contents of the only stomach examined. In August, it was 18 per cent of the food contents of the 10 stomachs. It was found in 7 stomachs and the highest percentage in a stomach was 60.

Only 1 cricket was taken, and it was taken in December.

Only 1 cockroach was taken, and it was taken in January.

Miscellaneous Insect Food

Diptera were taken in March, April, May and June. They were taken mostly in April, when they were 3 per cent of the food contents of the 15 stomachs examined.

Hemiptera were taken in April, May, June, and October. This order was taken mostly in April and June, when the percentages were about 1 per cent of the food contents of the 15 and 23 stomachs, respectively.

Only 2 Homoptera (family Jassidae) were taken in March.

In Hymenoptera, only insects belonging to the family Formicidae were taken. They were taken in March, May, August, September, and October, but most were taken in September, when they were 7 per cent of the food contents of the 9 stomachs examined.

Arachnida

Only 3 Arachnida were taken. Two were taken in April and one in May.

Vegetable Food

Vegetable food was 87 per cent of the yearly food contents of the 109 stomachs of the red winged blackbirds examined. The monthly percentages of the vegetable food were: January, 85; February, 98; March, 87; April, 75; May, 89; June, 84; July, 0; August, 75; September, 92; October, 89; November, 94; December, 99.

These birds are vegetarians. Not less than three-fourths of the monthly food contents of the stomachs was vegetable food. In July no vegetable food was taken. It is not wise to conclude that in July, then, birds do not take vegetable food, for only 1 stomach was examined and it happened that the only food it contained was locust.

Cereals**Wheat and Oat Grains**

Among the vegetable foods taken wheat grain was the highest in percentage. It was 17 per cent of the yearly food contents of the 109 stomachs examined. It was taken in every month except July, in which its presence is doubtful. In January, it was 46 per cent of the contents of 4 stomachs. It was found in 2 stomachs (see table 6) and it was 77 per cent of the food contents of 1 stomach. In February it was found in 1 of the 2 stomachs examined. It was 98 per cent of the food contents of that stomach. In April, it was 4 per cent of the food contents of the 15 stomachs. It was found only in 1 stomach and it was 90 per cent of the food contents of that stomach. In May, it was 3 per cent of the food contents of the 20 stomachs. It was found in 3 stomachs and it was the only vegetable food in 1

stomach. In June, it was 13 per cent of the food contents of the 23 stomachs. It was found in 8 stomachs and its highest percentage in a stomach was 89. In August, it was 66 per cent of the food contents of the 10 stomachs. It was found in 7 stomachs and its highest percentage in a stomach was 88. In September, it was 27 per cent of the food contents of the 9 stomachs and in 1 stomach there was no vegetable food except grains of wheat. In October, it was 27 per cent of the food contents of the 11 stomachs. It was found in 7 stomachs and in 1 stomach it was the sole vegetable food. In November, 2 of the 3 stomachs examined contained only grains of wheat. In December, the only stomach examined contained 33 per cent grains of wheat.

Oat grain was taken only in March. It was found in 1 stomach. Its highest percentage in a stomach was 78, and it was 3 per cent of the food contents of the 10 stomachs.

In northern California, north of the Sacramento Valley, these birds are quite destructive to the cereals. In this part of the State wheat grains are planted in spring and fall and these birds are apt to get the uncovered grains.

Sorghum Grain

Most of the grain of sorghum taken was of the wild one—Johnson grass (*Sorghum halepensis*). It was taken mostly in January, November and December. It was 9 per cent of the yearly food contents of the 109 stomachs. It was taken mostly in December, when it was 65 per cent of the food contents of the 1 stomach examined.

Miscellaneous Vegetable Food

Amaranthus blitoides was 4 per cent of the yearly food contents of the 109 stomachs. It was taken in April and June. Rough pig-weed (*Amaranthus retroflexus*) was 2 per cent of the yearly food of the 109 stomachs. It was taken in February and March. Common chickweed (*Stellaria media*) was 11 per cent of the yearly food contents of the 109 stomachs. It was taken in April, May, and June. Red-stem filaree (*Erodium cicutarium*) was 8 per cent of the yearly food contents of the 109 stomachs. It was taken in March, April, May, June, August, September, and October. It was mostly taken in May. Water grass (*Echinochloa crusgalli*) was 8 per cent of the yearly food contents of the 109 stomachs. It was taken in January, September and October. It was taken mostly in September. *Lupinus* was taken in March and September. It was 8 per cent of the yearly food contents of the 109 stomachs. *Montia* was 2 per cent. It was taken in May and June. *Datisca glomerata* was taken in May. *Polygonum* was taken in January, April, May, August, September, October and December. It was widely taken but the percentages were very low. *Amsinckia* was taken only in June.

Group II

Animal Food

Animal food was 30 per cent of the yearly food contents of the 80 stomachs of red-winged blackbirds examined. Out of 30 per cent animal matter, 29 per cent was insect food. The monthly percentages of insect food were: January, 9; February, 25; March, 37; April,

19; May, 59; June, 86; July, 96; August, 39; October, 2; November, 12; December, 0. No stomach taken in September was examined.

Coleoptera—Beetles

Coleoptera made up 20 per cent of the yearly food contents of the 80 stomachs examined, showing that beetles dominated in the insect food. The chief families of beetles taken were: hister beetle (Histeridae), rove beetle (Staphylinidae), leaf beetle (Chrysomelidae), weevil (Curculionidae), ground beetle (Carabidae), June beetle (Scarabaeidae), darkling ground beetle (Tenebrionidae).

The rove beetle family was the highest in percentage among all the families of beetles taken. It was 2 per cent of the yearly food of the 80 stomachs. It was taken in February and mostly in August, where it was 4.6 per cent of the food contents of the 12 stomachs examined. Economically this family is not important.

The family Histeridae was the second in rank. It was taken only in August, when it was 3 per cent of the food contents of the 12 stomachs examined. This family of beetles is not important economically.

The leaf beetle family was the most widely taken. It was 1 per cent of the yearly food of the 80 stomachs. It was taken in February, April, May, June, August, and November. In February, it was 16 per cent of the food contents of the 7 stomachs examined. In April, it was 1 per cent of the food contents of the 6 stomachs. In June, it was 14 per cent of the food contents of the 2 stomachs. In August, it was less than 1 per cent of the food contents of the 12 stomachs. In November, it was 6 per cent of the food contents of the 4 stomachs. They are destructive beetles and their elimination is desirable.

Weevils were taken in April, May, and August. In August, they were less than 1 per cent of the food contents of the 12 stomachs. In April, they were 4 per cent of the food contents of 6 stomachs. In May, they were 8 per cent of the food contents of the 16 stomachs. They were found in 4 stomachs and its highest percentage in a stomach was 50. Weevils are destructive beetles and their elimination is highly desirable.

Ground beetle family was taken in January, April and May. It was taken mostly in April and May when they were 4 and 6 per cent of the food contents of the 6 and 16 stomachs, respectively. Economically these beetles are not important.

The darkling beetle group was taken in January, February, June, and November. Only a few were taken. Carrion beetles were taken in March, April, May, and July. Only small numbers were taken. Only 2 click beetles were taken—1 in April and 1 in October. Only 2 metallic wood borers were taken and they were taken in February.

Lepidoptera—Caterpillars

Caterpillars were 2.4 per cent of the food contents of the 80 stomachs. This group was taken in March, May, October, and November. It was taken mostly in March and May when it was 11 and 26 per cent of the food contents of the 2 and 16 stomachs, respectively. Caterpillars are not desirable, being destructive insects.

Orthoptera—Locusts and Crickets

Locusts were 4 per cent of the yearly food contents of 80 stomachs. They were taken mostly in January, March, May and July. In January, they were 3 per cent of the food contents of the 11 stomachs. In March, they were 5 per cent of the food contents of the 2 stomachs. In May, they were 6 per cent of the food contents of 16 stomachs. They were taken most often in July. They were 93 per cent of the food contents of 4 stomachs. They were found in 3 of the 4 stomachs and the highest percentage in a stomach was 100.

Crickets were taken in January, April, May, and June. They were .6 per cent of the yearly food contents of the 80 stomachs.

Both of these families of insects are destructive. Their elimination is also desirable.

Homoptera

Aphids were taken in May, comprising 25 per cent of the food contents of the 16 stomachs. They were 2 per cent of the yearly food contents of the 80 stomachs. Aphids are destructive insects and their elimination is highly desirable.

Miscellaneous Insect Food

Diptera were taken in May and mostly in August, being 2 per cent of the yearly food contents of the 80 stomachs.

Only 5 Hemiptera were taken, 4 in May and 1 in August.

Chilopoda and Arachnida

Only 4 Chilopoda were taken in April. They belonged to the family Geophilidae. Only 1 arachnid was taken in January.

Vegetable Food

Vegetable food was 70 per cent of the yearly food contents of the 80 stomachs. The monthly percentages of vegetable food were: January, 91; February, 75; March, 63; April, 81; May, 42; June, 14; July, 4; August, 61; October, 98; November, 88; December, 100. (See table 2.)

Cereals**Wheat Grain**

Out of the 70 per cent of yearly vegetable food of the 80 stomachs, 13 per cent was wheat grain and 4 per cent was oat grain.

Wheat grain was taken in January, February, April, May, June, August, October and November. In January, it was 16 per cent of the food contents of the 11 stomachs. It was found in 4 (see table 6), and the highest percentage in a stomach was 97. In February, it was 28 per cent of the food content of the 7 stomachs. It was found in 3 stomachs and the highest percentage in a stomach was 87. In April, it was 10 per cent of the food contents of the 6 stomachs. It was found only in 1 stomach and the percentage in that stomach was 77. In May, it was 26 per cent of the food contents of the 16 stomachs. It was found in 3 stomachs and the highest percentage in a stomach was 90. In June, it was 14 per cent of the food contents of the 2 stomachs. In October, it was 22 per cent of the food contents of 8 stomachs. It was found in 2 stomachs and 1 stomach contained

only wheat grain as vegetable food. In December, it was 63 per cent of the food contents of the 8 stomachs. It was found in 2 stomachs and 1 stomach contained only wheat grain as food.

Oat Grain

Oat grain taken was 4 per cent of the yearly food contents of the 80 stomachs. It was taken in January, March, April, and May. In January, it was 30 per cent of the food contents of the 11 stomachs examined. It was found in 1 stomach, and the percentage in that stomach was 70. In March, it was 70 per cent of the food contents of 2 stomachs and it was 100 per cent in 1 of the stomachs. In April and May, it was 1 and 5 per cent of the food contents of 6 and 16 stomachs, respectively.

Rice Grain

Rice grain was 6 per cent of the yearly food contents of the 80 stomachs. It was taken in August and November. In August, it was 11 per cent of the food contents of the 12 stomachs examined. It was found in 5 stomachs and the highest percentage in a stomach was 84. In November, it was 59 per cent of the food contents of the 4 stomachs. It was found in 2 stomachs and in one of these it was 100 per cent.

Planting of wheat is done in the months of November to February and harvest takes place in June to July. In the planting season the grains of wheat taken by these birds are high in percentages and if these grains are taken from the sown fields, for these birds are apt to get the uncovered grains, then these birds at this time of the year are destructive. At harvest season more insects are taken than grains of wheat, showing that they prefer insects when available to grain. At this time of the year the birds are beneficial.

Planting and harvesting season for oats is much the same as for wheat. To oats the birds are also destructive.

Planting of rice grain is done in April to May, and harvesting is done from October to December. The grains of rice taken in August are considered waste grains, but those taken in December, which are high in percentage (for the sole food found in 1 stomach was grains of rice) are considered valuable. If these grains were taken in the field, then red-winged blackbirds are destructive to rice crops at this time of the year.

Miscellaneous Vegetable Food

Water grass (*Echinochloa crusgalli*) was taken the most often. It was 16 per cent of the food contents of the 80 stomachs examined. It was taken in August and October, but mostly in August, when it was 12 per cent of the food contents of the 12 stomachs.

Knotweed (*Polygonum*) was 9 per cent of the yearly food contents of the 80 stomachs. It was taken in January, May, July, August, October, November and December. In November and December it was 28 and 36 per cent of the food contents of the 4 and 8 stomachs, respectively.

Panic grass (*Panicum*) was 6 per cent of the yearly food of 80 stomachs. It was taken only in October.

Red-stem filaree (*Erodium cicutarium*) was 5 per cent of the yearly food contents of the 80 stomachs. It was taken in January, April, May,

August and December. It was taken mostly in May, when it was 17 per cent of the food contents of the 16 stomachs.

Rough pigweed (*Amaranthus retroflexus*) was 4 per cent of the food contents of the 80 stomachs. It was taken in February, April, May, and August. It was taken mostly in April, when it was 72 per cent of the food contents of the 6 stomachs.

Wild barley (*Hordeum*) was taken only in August. It was 7 per cent of the food contents of the 12 stomachs.

Other plants were also taken, but their percentages are too small to be important.

Group III

Animal Food

There were only 26 stomachs of red-winged blackbirds in this group. These stomachs were taken in April, May and June, and the numbers of stomachs in each month were: April, 7; May, 16; June, 3. In these 3 months, the percentage of animal food found in these 26 stomachs was 71, all insects.

Coleoptera—Beetles

Beetles were 30 per cent of the food contents of these 26 stomachs. The most important families of beetles taken and their percentages in the food contents of the 26 stomachs were: June beetle (*Scarabaeidae*), 3; weevil (*Curculionidae*), 13; leaf beetle (*Chrysomelidae*), 6; carrion beetle (*Silphidae*), 3; darkling ground beetle (*Tenebrionidae*), 3; ground beetle (*Carabidae*), 2.

June beetles were taken mostly in April. They were 3 per cent of the food contents of 7 stomachs. Weevils were taken mostly in April, when they were 24 per cent of the food contents of the 7 stomachs. Leaf beetles were taken mostly in May, when they were 8 per cent of the food contents of the 16 stomachs. Carrion beetles were taken mostly in April, when they were 33 per cent of the food contents of the 7 stomachs. Darkling ground beetles were taken mostly in April, when they were 5 per cent of the food contents of the 7 stomachs. Ground beetles were taken mostly in June.

Miscellaneous Insect Foods

Diptera made up 13 per cent of the food contents of the 26 stomachs, being taken mostly in April.

Homoptera made up 4 per cent of the food contents of the 26 stomachs. They belonged to the leafhopper family (*Jassidae*). They were taken only in May.

Lepidoptera were taken in June, and constituted 4 per cent of the food contents of the 26 stomachs.

The order Hymenoptera made up 21 per cent of the food contents of the 26 stomachs. It was taken in May, and was represented by the family of ants (*Formicidae*).

Vegetable Food

Vegetable food made up 29 per cent of the food contents of the 26 stomachs. Most of the vegetable matter taken was wheat and oat grain. Wheat grain was taken every month and the percentages in

each month were: April, 26 in 7 stomachs; May, 11 in 16 stomachs; June, 7 in 3 stomachs.

Oat grain was taken in April and May, and the percentages were 7 and 3, respectively.

Knotweed was also taken in May and June.

Johnson grass was taken in June and red-stem filaree was taken in May and June.

In these months these birds are beneficial, for insects are taken in greatest proportion as a part of their diet. Cereals taken in these months are considered waste grain, and economically they amount to nothing at all.

SUMMARY

The Brewer blackbirds in geographic group I are found to be more vegetarian than insectivorous. Insects are taken in greatest proportion from May to July (see table 1). Insect food in January is 49 per cent of the total, and it rises up to June and July when it reaches the highest percentages, then it goes down until December, when it reaches the lowest percentage, roughly speaking; for the rise and fall are not continuous.

Vegetable food is in highest percentage when insects are taken least, due to their scarcity. Insects hibernate during winter and they are not easily found by these birds. In the absence of insects, vegetable food is resorted to. In the months when insects and vegetable food, especially cereal in the harvest season, are both abundant, vegetable food is taken less, showing that these birds are primarily more insectivorous in food habits than vegetarian.

Most of the insects taken belong to the destructive families of insects from the point of view of the farmer and fruit grower. Very few of the beneficial insects are taken. The destruction of these harmful insects means a great help to farmers and growers in particular, and to consumers in general.

Cereals are the vegetable foods taken most. They are taken almost every month, whether it be harvesting or planting season. In June and July, which are the harvest months, the percentage of cereals taken, if taken at all (it happened that in group I no cereal was taken), is very low, because at this time insects abound. From November to February and August to October, the planting seasons, in this group (I), most of the vegetable matter taken is cereal. But most of this cereal is not taken from the newly planted seeds, for the birds take sown seeds uncovered, as also grain from pastures, barnyards, orchards and grain fields. Economically, this cereal is not important and it can be considered waste grain.

The rest of the vegetable food is almost all weed seeds. Bryant (1914) defines weeds as "plants out of place." These plants are not economically important, but their destruction is desirable because, if they are allowed to grow, they compete with the cultivated plants which results in the diminution of the crop's yield, in quantity as well as in quality. If weeds are not to be allowed to compete with the crops, a certain amount of energy and time is expended by the farmer toward their destruction. By the destruction of the seeds of weeds, blackbirds give appreciable help to the farmers.

Brewer blackbirds in geographic groups II and III were found to be practically the same in food habits and economic status as those of Group I. (See table 1.)

The red-winged blackbirds are found to have, as a rule, the same food habits and economic status as the Brewer blackbirds except that the red-wings in Group I get less cereal in their yearly food. The difference is not great. This difference is due, perhaps, to the fact that more stomachs of the red-winged blackbird were obtained in April and May, the breeding months, when they feed mostly on insects and when insects are more abundant. On the other hand, fewer stomachs of the other species were examined in these two months. In Group I more vegetable food was taken in all the months in spite of the fact that more stomachs were examined, showing that red-winged blackbirds are more vegetarian than the Brewer blackbirds.

The Brewer and red-winged blackbirds, in food habits, are both primarily insectivorous. But in the absence of insects they are vegetarian, and cereal is taken whenever it is available. Being gregarious birds before and after the breeding season their depredations in grain fields cannot be denied. The degree of destruction that they do depends upon the size of a flock and the size and location of the grain field. Their destruction could be easily felt, if the flock is big and the grain field is small; the reverse also is true.

CONCLUSION

Economically, in the widest human interests, the Brewer and red-winged blackbirds are beneficial, being more insectivorous than vegetarian in food habits. However, being gregarious birds, they can now and then inflict such great damage on crops that to give them full protection is not fair to the farmer whose crops are immediately threatened. It is wisest, then, that these birds be protected during the breeding season when they destroy many insect pests, and that farmers and growers allow them to nest on their farms. But when and where they become vegetarian and inflict real damage to crops, then their numbers should be reduced, though only to such degree that the damage done by those remaining can hardly be felt.

We need the record of more observations of this sort in order that we may better verify the facts and more accurately fix the dates.—
N. B. Scofield, 510 Russ Building, San Francisco, August 17, 1931.

TABLE 1
Proportions of Important Kinds of Food of the Brewer Blackbird. Showing the Percentages of All the Food for Each Month

Group I

	January	February	March	April	May	June	July	August	September	October	November	December
No. of Brewer Blackbirds.....	10	20	22	21	14	9	2	2	12	2	9	5
Insect food.....	49	61	55	9	70	100	81	16	11	44	5	3
Vegetable food.....	51	39	45	91	30	0	19	84	89	56	95	97
Coleoptera.....	29	15	17	5	62	96	0	0	2	0	1	0
Cereal.....	26	27	29	16	9	0	0	84	55	39	82	72

Group II

	January	February	March	April	May	June	July	August	September	October	November	December
No. of Brewer Blackbirds.....	19	9	18	12	3	1	7	-----	7	-----	8	6
Insect food.....	14	11	22	14	35	100	100	-----	1	-----	0	19
Vegetable food.....	86	89	78	86	65	0	0	-----	99	-----	100	81
Coleoptera.....	9	7	4	12	29	33	44	-----	0	-----	0	4
Cereal.....	63	54	8	23	0	0	0	-----	30	-----	16	51

Group III

	January	February	March	April	May	June	July	August	September	October	November	December
No. of Brewer Blackbirds.....	13	12	2	4	3	4	-----	-----	-----	12	11	11
Insect food.....	24	0.9	-----	75	74	83	-----	-----	-----	20	8	0
Vegetable food.....	97.6	99.1	-----	25	26	17	-----	-----	-----	80	0.9	100
Coleoptera.....	1	0.8	-----	71	63	6	-----	-----	-----	3	92	0
Cereal.....	32	59	-----	25	15	12	-----	-----	-----	59	12	2

TABLE 2
Proportion of Important Kinds of Food of the Red-Winged Blackbird. Showing the Percentages of All the Food for Each Month

Group I

	January	February	March	April	May	June	July	August	September	October	November	December
No. Red-winged Blackbirds	4	2	10	15	20	23	1	10	9	11	3	1
Insect food.....	15	2	13	25	11	16	100	25	8	11	6	1
Vegetable food.....	85	98	87	75	89	84	0	73	92	11	94	99
Coloptera.....	8	1	11	16	17	15	0	5	1	5	6	6
Cereal.....	46	23	3	4	3	13	0	66	27	27	27	33

Group II

	January	February	March	April	May	June	July	August	September	October	November	December
No. Red-winged Blackbirds	11	7	2	6	16	2	4	12		8	4	8
Insect food.....	9	25	37	19	58	86	96	39		2	12	0
Vegetable food.....	91	75	63	81	42	14	4	61		98	88	100
Coloptera.....	2	20	21	12	18	71	2	9		0.4	7	7
Cereal.....	16	7	63	11	31	14	0	11		22	59	63

Group III

	January	February	March	April	May	June	July	August	September	October	November	December
No. Red-winged Blackbirds					7	16	3					
Insect food.....					65	84	55					
Vegetable food.....					35	16	65					
Coloptera.....					42	38	12					
Cereal.....					33	14	7					

	16	28	29	13	21	16	3	1	12	4	3	2	14	13	30	12	7	2	13		4		6	7	2		8	8	10		13	9	4
Blattidae																																	
Gryllidae																																	
Locustidae																																	
Unidentified																																	
Chilopoda																																	
Geophilidae																																	
Unidentified																																	
Arachnidae																																	
Insecta (unidentified)																																	
Totals																																	

[illegible]

[illegible]

FIRST ANNUAL BLACK SEA BRANT CENSUS IN CALIFORNIA

By JAMES MOFFITT

THE BLACK SEA BRANT (*Branta bernicla nigricans*) is a regular winter visitant to the larger bays of California that support a growth of eel grass (*Zostera maritima*). The dependence of brant on the plant for food is so great that the birds never remain on waters where it does not exist for any length of time. Brant are abundant winter visitants to Humboldt, Bodega, Tomales, Drakes and Morro bays on the California coast. Small numbers still occur on Mission Bay, near San Diego, where they were formerly abundant and occasional flocks visit San Francisco Bay, chiefly off Redwood City where they have been observed every spring. Brant are also common winter visitants to the bays and estuaries of the Lower California



Fig. 104. Black brant resting and preening on sand bar, Tomales Bay, March 12, 1931. Enlarged from motion picture film by E. S. Cheney.

coast where they have been reported in numbers from San Quentin Bay, Scammon, Pond and San Ignacio Lagoons, south to Magdalena Bay. They also winter north on suitable bays along the Oregon and Washington coasts as far as southern British Columbia.

Black brant are extremely northerly nesters and breed along the Arctic Ocean coasts of North America and Siberia. In Alaska they are not known to breed south of the Seward Peninsula. The first approach of winter drives the birds from their breeding grounds in these high latitudes early in the fall. Many black brant nest along the Arctic coast east of Point Barrow to Melville Island and Banks Land. These birds migrate westward in fall past Point Barrow, then southward along the Alaskan coast. This migration commences at Barrow in mid-

August and all have left this point by the end of September. The birds apparently tarry a long while on their southern flight from Barrow to California for they are among the latest migrants to reach our shores. My earliest fall records for Tomales Bay, Marin County, are November 17, 1927, November 11, 1928, and November 10, 1929. The first arrivals here appear to continue on down the coast, probably to Mexico, and the species is never numerous in our waters until late November or early December. Their numbers increase from that time until February when the maximum is reached. The population is about stationary during this month and March, and April finds the northward migration commencing. The birds are slow to depart and though the exodus is at its height in late April, the last birds do not leave until the end of May. Evidently the spring migration is much more hurried than the fall movement for brant arrive on their breeding grounds early in June. There are little data available concerning the migration dates of brant in Lower California; but some claim the birds arrive there in numbers earlier in the fall than they do in our State. This sounds unreasonable; but if true, the increase in numbers of our brant from December to February may be caused by an early northward movement of Lower California birds, rather than by an infiltration of birds from the north as I prefer to believe is the case.

M. Hall McAllister pointed out in his excellent article on this species in the January, 1930, issue of *Associated Sportsmen*, that black brant have held their numbers remarkably well during the past 30 years, whereas the upland species of geese have decreased in abundance alarmingly. This condition has been noted by all familiar with the birds, and though brant are certainly less numerous than they were a quarter century ago, they are comparatively much more abundant than our other geese. This condition is doubtless mainly due to the brant's wariness and maritime habits plus the fact they have not been hunted with live decoys.

I became greatly interested in the sea brant on Tomales Bay in 1927 and commenced a study of them in the fall of that year that is still in progress. Visiting Tomales Bay on November 21 of that year, I found the birds just arriving and only three flocks totalling 40 birds were noted. Henry J. Jensen, a resident of the bay, told me he noted the first brant that fall on November 17 when several hundred birds appeared, to continue on south after a brief stop. January 1, 1928, I estimated between 5000 and 6000 black brant on Tomales Bay and noted the fact that there appeared to be a trifle more birds present than at the same time in 1926 and considerably more than on January 1, 1925.

Commencing in March, 1928, I made monthly censuses of the waterfowl on Tomales Bay whenever possible until May, 1929, in cooperation with the U. S. Bureau of Biological Survey. The area, on account of the long narrow shape of the bay, is almost ideal for census work and the results obtained are certainly 90 per cent correct. The

counts for black brant are provided herewith to show the abundance of the species in different months:

March 11, 1928-----	3135
April 8, 1928-----	1837
May 6, 1928-----	87
September 20, 1928-----	None
October 13, 1928-----	None
November 11, 1928-----	270
December 16, 1928-----	3087
January 20, 1929-----	2490
March 24, 1929-----	6280
April 7, 1929-----	3271
May 12, 1929-----	51

In explanation of the fact that nearly twice as many birds were noted in March, 1929, as in 1928, it should be pointed out that the brant spent considerable time on the ocean off Tomales Bay. Further, the birds doubtless fly back and forth between Tomales, Bodega and Drakes bays so in order to get an exact count of the birds in this region, censuses should be made on all three bays and, if practical, on the



Fig. 105. Black brant on shore and water. Tomales Bay, March 12, 1931. Enlarged from motion picture film by E. S. Cheney.

adjacent ocean too. Weather and tidal conditions greatly affect the number of birds on the bays and ocean. The brant fly in to feed in the bays with an incoming tide and go out to the ocean to roost on ebb tides. If the day be calm and warm, more birds loaf on the ocean than in cloudy or stormy weather when they seek protection in the calmer bays. A large number of the birds spend the night on the ocean, flying from the bays at dusk to return to feed shortly after daylight.

Upon my association with the Division of Fish and Game early this year, I advocated that an annual census of black sea brant be made in California. Leo K. Wilson, Chief of the Bureau of Education and

Research, readily agreed to this suggestion and February 11 and 12 were chosen the dates for the count, when we considered the maximum of the birds would be present on our waters. It is believed that annual censuses, made on the same grounds, on the same date, and if possible by the same observers over a period of years, will provide valuable and interesting information concerning the perpetuation of this species. It is indeed regrettable that it is so difficult to make similar censuses of other game birds; but their wider distribution makes this impractical. Such annual "stock-takings" provide invaluable data for future conservation.

We determined to take censuses on Humboldt, Tomales, Morro and San Diego bays. On account of lack of time to organize cooperators, counts on Bodega and Drakes bays were not attempted, though these areas will probably be included in future censuses. The officials of the San Diego Natural History Museum, through its director Clinton G. Abbott, cooperated in every way and L. M. Huey and F. F. Gander of its staff took the census on San Diego and Mission bays. C. I. Clay and F. J. Smith, of Eureka, kindly volunteered to take the census on Humboldt Bay. Acknowledgment and appreciation of these gentlemen's cooperation is hereby made. L. K. Wilson and I took the census on Morro Bay and I made the count on Tomales Bay.

The results of the censuses are tabulated below:

Locality	Date	Time	Observer	Number of birds
Humboldt Bay	Feb. 6, 7, 8	—	F. J. Smith	4,100
Humboldt Bay	Feb. 11, 12	All day	C. I. Clay	500,000
Tomales Bay	Feb. 12	8:00 a.m.—	James Moffitt	9,445
		3:00 p.m.		
Morro Bay	Feb. 10	3:00 p.m.—	L. K. Wilson	4,493
		5:30 p.m. and	James Moffitt	
Mission Bay	Feb. 12	"Low tide"	L. M. Huey and	71
			F. F. Gander	
San Diego Bay	Feb. 12	"Low tide"	L. M. Huey and	
			F. F. Gander	none



fig. 106. Black brant feeding and preening. Immature gulls in right foreground. Tomales Bay, March 12, 1931. Enlarged from motion picture film by E. S. Cheney.

A great discrepancy will be noted between Mr. Smith's and Mr. Clay's figures for Humboldt Bay. This might be explained by a sudden influx of large numbers of brant between February 8 and 11, or more probably by the fact that the main body of birds may have been resting on the ocean when Mr. Smith made his counts and on the bay when Mr. Clay observed them.

Mr. Smith advises the results of his counts by letter on February 10, stating he observed 1100 brant on North Humboldt Bay, near Mad River Slough, February 6, and the same number of birds north of Bird Island, February 7. On February 8, this observer counted 3070 brant on South Humboldt Bay, noting large flocks estimated at 1000 birds each near Hookton and the Peninsula and smaller flocks near Fields Landing and the "dyke." He wrote that the small bunches of brant flew around greatly and that he judged approximately 3000 birds for South Bay and 1100 for North Bay would be correct figures.

C. I. Clay wrote as follows on February 12:

"Your letter of January 29 is at hand; requesting information on wintering grounds of *Branta nigricans*, a census on Humboldt Bay February 11 and 12, 1931.

"On both dates mentioned above, I scanned the north bay from Arcata to Samoa and along all channels without seeing a single bird, *Branta nigricans*. If any were there, they must needs be but a few isolated specimens.

"On the south bay, between Fields Landing and the Table Bluff ridge, peninsula triangle, things were entirely different. At high water during the day, there were so many brant I will not venture a count. The entire South Bay was a black and white checkerboard, so to speak, with *Branta nigricans*. Literally their numbers must total many thousands, there being miles of them all in a solid mass.

"These birds winter on the South Bay and often light in massed flocks on the ocean, directly west of the bay. I could not observe the ocean from my position the past two days.

"The two days were calm of wind, clear sunshine till late afternoons, when cirro-stratus clouds set in."

I wrote Mr. Clay on February 16 requesting his estimate of the number of brant he noted on South Humboldt Bay February 11 and 12. His kind reply of the 22nd is quoted as follows:

"As you are asking me to give you an approximation of the numbers seen on South Bay, I will venture a count upon second thought, for I have since roughly checked the acreage of brant covered waters and will advisedly state the number of birds estimated, to my own belief, is way short of the actual *Branta nigricans* population of the great South Bay on February 11 and 12, 1931.

"500,000 squawking, floating, black and white, feathered bird forms in the background, where the space between individuals seemed a mater of shadowed waters, gradually closing in perspective with receding distance, till water and birds seemed one homogeneous mass of moving life, only to be broken by distant stretches of bleached sand dunes as vision reached the barrier between bay and ocean."

It is apparent that there were tremendous numbers of black brant on Humboldt Bay when Mr. Clay made his count, and though his figure of half a million birds seems almost incredible, his graphic description

of their number conveys the impression of the magnitude of this concentration.

The counts for the other localities are considered to be at least 90 per cent correct. The census commenced at Morro Bay at 3:00 p.m., February 10, at approximately low tide. All the brant in the vicinity were apparently in the bay, feeding on the incoming tide while the count was being made. Most of the birds were grouped along the southeast corner of the bay. At dusk they rose, to fly out to the ocean to roost for the night. A tremendous number of brant were found on Tomales Bay when the census was taken there February 12. The count secured was the highest of twelve censuses taken at this point by me and exceeded my highest previous count, 6280 birds on March 24, 1929 by more than 3000 birds. Most of the brant were in the bay opposite Hamlet and a satisfactory count was secured.

It is apparent that brant are abundant winter visitants to the localities in California mentioned in this paper and their numbers appear to have increased somewhat in the past few years. Annual censuses of the present character over a period of years should definitely establish their future status.

NORTHWARD OCCURRENCE OF SOUTHERN FISH OFF SAN PEDRO IN 1931

By LIONEL A. WALFORD

DURING THE WINTER of 1930-1931, and the spring and summer of 1931, unusually warm weather has prevailed along the southern California coast. Figure 1 shows the deviations from the average air temperatures since July, 1930, which probably correlate closely with the ocean temperatures for the same period. That these high temperatures have been accompanied by an unusual appearance of tropical fish in the waters of southern California has been indicated by the number of southern fish brought to California State Fisheries Laboratory for identification.

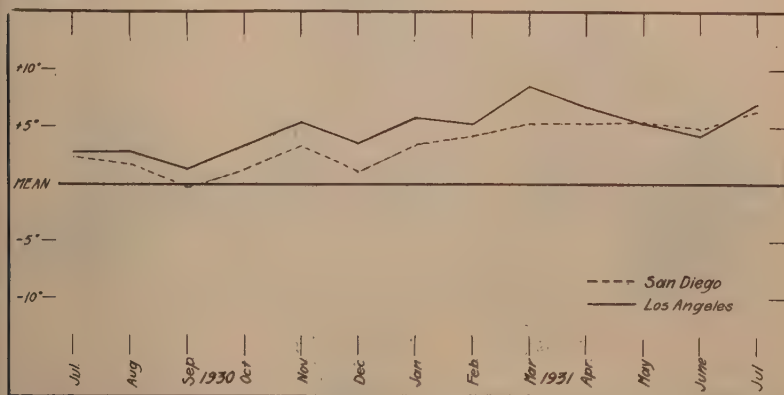


Fig. 107. Air temperatures in southern California have been above normal since September, 1930. The graph shows the deviations from the average monthly temperature.

A rather large number of the sharp-nosed flying fish, *Fodiator acutus*, was taken at various times during the month of June by round haul fishermen. This fish, which has evidently not been noted from as far north as San Pedro before, is recorded from the Gulf of California southward to Panama on the Pacific side, as well as in the tropical Atlantic and from southern France. It is considerably smaller than the California flying fish, scarcely exceeding seven inches in length. It differs from ours in having a pointed lower jaw, a much higher dorsal fin, and a pectoral fin which does not reach past the dorsal fin. Its color is dark greenish blue on the back, growing abruptly silvery at the side, an opalescent violet band about the width of the eye extending along the lower part of the side. The lining of the mouth is a beautiful peacock blue.



Fig. 108. Sharp-nose flying fish, *Fodiator acutus*. Photo by Richard S. Croker.

A large triggerfish, *Balistes polylepis*, was taken off San Pedro in March, and another in July by round haul fishermen. This fish has been recorded from San Diego to Panama, but it is a rare visitor as far north as Los Angeles County. It is easily recognized by the very hard



Fig. 109. Triggerfish, *Balistes polylepis*. Photo by Richard S. Croker.

skin and the small gill opening with the plate-like scales behind. The color is grayish brown, the scales tipped with blue. The name triggerfish is derived apparently from some fancied analogy to the ability of the fish to lock the large spine of the first dorsal fin so that it is immovable, and to unlock it at will.

A spadefish, *Chaetodipterus zonatus*, was taken off San Pedro during May. The usual range of this fish is from San Diego to Panama, and so far as we know, it has not been reported as far north as San

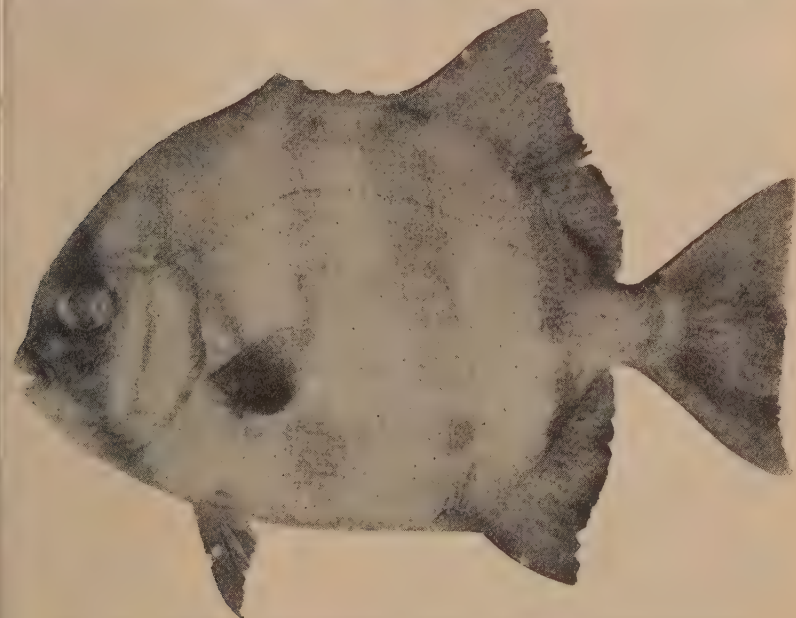


Fig. 110. Spadefish, *Chaetodipterus zonatus*. Photo by Richard S. Croker.

Pedro before. The color is grayish silvery with blackish cross bands as shown in the photograph.

Several Japanese herring, *Etrumeus micropus*, a rather rare visitor to this region, were seen in the markets this year. These were large specimens, around 14 inches long, apparently sexually mature.

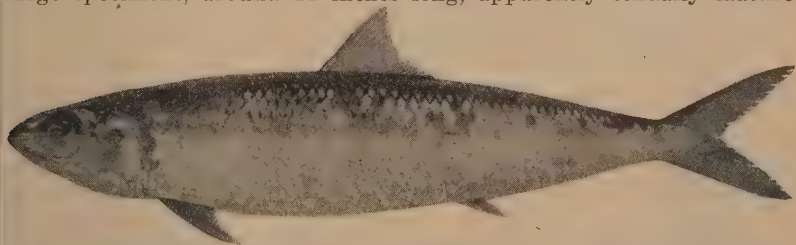


Fig. 111. Japanese herring, *Etrumeus micropus*. Photo by Richard S. Croker.

These fish are found also in Japan and Hawaii, where they are much commoner than they are here, being the principal food fish of the northern part of the Japanese Empire. They differ from our other

herring-like fishes in having the ventral fins attached entirely behind the dorsal fin.

A hammerhead shark, *Sphyrna zygaena*, was landed at San Pedro in July, and another at Santa Monica. This curious fish is taken occasionally off San Diego, but is rarely landed farther north, possibly because there is no factory utilizing sharks in Los Angeles or Orange counties, but also possibly because these places are out of its range. The last time the writer saw hammerheads in San Pedro markets was in 1926, another year of unusually warm weather.* These sharks are easily recognized by the sideward extension of the head to form a hammerlike structure, the eyes being on the ends of these extensions.



Fig. 112. Manta delivered to San Pedro, July 27, 1931. This specimen measured fourteen feet across. Photo by D. H. Fry, Jr.

Small specimens are rarely if ever seen in these parts, the one landed in San Pedro being about nine feet long.

The most remarkable catch of the year, given publicity all over the country from coast to coast, was that of the giant ray, *Manta birostris*, landed at San Pedro. Another specimen was seen off the fishing barge at Avalon, and another off Santa Cruz Islands. This fish, recorded from San Diego southward on the Pacific coast, and from New Jersey southward on the Atlantic, has probably never been seen on the Pacific side as far north as San Pedro. They are easily recognized by the two fleshy appendages on the head, which look like horns and which give to the fish the grotesque name "devilfish." A more acceptable and exact name, however, and that used by the California Division of Fish and Game, is "manta." These appendages are used in feeding, as hands, the fish moving slowly through a school

of small fish, turning from side to side, constantly moving these head appendages to fan the small fish into the mouth. Although mantas grow to a great size, attaining a width of twenty-five feet or more, they have been frequently observed to leap almost clear out of the water. The specimen taken at San Pedro was fourteen feet across, and weighed about a ton.

* Hubbs, Carl L., and Schultz, Leonard P. The northward occurrence of southern forms of marine life along the Pacific coast in 1926. California Fish and Game, 1929, vol. 15, pp. 234-241.

Attached to the manta was the largest remora we have seen—thirty-four inches long. These fish have a curious sucking disc on the top of their heads, which enables them to stick to the sides, or even to the walls of the gill chambers of large sharks and rays. They ride along with their host, sharing his food and enjoying immunity from being eaten themselves.



Fig. 113. Fourteen-pound remora, which was attached to the manta. Photo by D. H. Fry, Jr.

It will be interesting to hear whether people from other points along the coast have observed this unusual movement of marine life, of invertebrates as well as of fish. Hubbs and Schultz* have recorded such a phenomenon for 1926. Perhaps at the close of the year a similar record may be available for 1931.

A REVIEW OF NEW PUBLICATIONS ON CALIFORNIA FISHERIES

THE California Bureau of Commercial Fisheries has recently issued four new publications, Fish Bulletins 28-31, for which there is an unusual demand by persons engaged in the fishing industries, by scientists, and by the general public.

Copies of any of these interesting booklets may be obtained free of charge from the California State Fisheries Laboratory, Terminal Island, California.

A review of these bulletins is given below:

Handbook of Common Commercial and Game Fishes of California.

Fish Bulletin 28, "Handbook of Common Commercial and Game Fishes of California," by Lionel A. Walford is an illustrated booklet making a splendid reference for the easy identification of about one hundred and thirty of the common species of fishes found in the waters of this state. The book is not written for fisheries scientists, but is intended for use by commercial fishermen, anglers, fish dealers, housewives and the citizens interested in our fisheries resources.

The chief purpose in preparing this bulletin in the first place was to bring order out of the chaos of common names used for fishes. Confusion in the past arose through using several names for the same species and again in applying the same name to two or more dissimilar fishes. This was an annoyance to anglers, caused difficulties in the sales departments of fish dealers, especially in filling out-of-the-State orders and in addition, the loose use of names endangered the accuracy of the State's

* *Loc. cit.*

records of the commercial catch. These records form the basis of the conservation program of the Bureau of Commercial Fisheries, and are used not only in administering the activities of the Bureau, but also serve as the foundation for most of the research work which has proven of such worth in determining the effects of man's fishing upon our fish supply. As provided by law, the Bureau of Commercial Fisheries published in this bulletin an official list of common names so that each fish might have one, and only one, name, and it is gratifying to note the ready response of the trade in applying these official names in their bookkeeping systems.

Anyone using the book has little trouble in identifying the fish under discussion, as a clear photograph of the fish appears at the top of each page. Directly under the photograph the official name is printed in bold-faced type with the scientific name below it in small italics. The text at the bottom of the page serves the double purpose of further identifying the species and giving briefly some interesting information concerning the particular fish illustrated above. For each species the family name is given and other close relatives in local waters are mentioned. The distinguishing characters by which the fish may be readily recognized are given so that the reader need not confuse two species similar in appearance. This is followed by statements as to the occurrence and distribution of the fish with notes on the seasonal runs, commercial and angling importance, and the gear most frequently used in the fishery.

Anyone wishing to identify a fish by the use of a key will find at the front of the book a very simple and easily used key in which technical language has been omitted whenever possible. A glossary and drawings define the anatomical terms used. At the back of the book there is a glossary of the names of fishing gear and an article describing the meaning and use of the scientific or Latin names of animals.

For many years there has been a great necessity for such a handbook, and Bulletin 28 is a very creditable response to the need for a simple and easily used manual.

The Striped Bass of California.

There are not very many fishery problems which have yielded such useful and satisfying results as the striped bass investigation conducted by the Bureau of Commercial Fisheries and completed this year with the publication of "The Striped Bass of California," by Eugene C. Scofield. A first report, "An Analysis of the Catch Statistics of the Striped Bass Fishery of California," by J. A. Craig, was a study and evaluation of the relative abundance of this fish. From it we know fairly definitely that the striped bass population is not at present in danger of depletion. If any future catch analysis should show a depleted population, one can intelligently devise legislation on the basis of a knowledge of the life history. Scofield's paper adequately provides this basis.

The first part of the book presents a picture of the striped bass fishery of California. The description, care and operation of fishing gear, as well as the handling and sale of the catch are here described in readable, nontechnical style.

"The Life History of the Striped Bass," which is Part II of Scofield's report is of a more technical nature than the first section. Life

history studies can concern themselves with any number of questions, many of which would be of more popular interest, but of less actual value to sportsmen and commercial men than the problem to which Scofield has confined his work. We learn that bass grow rapidly during the first year, gradually less rapidly during succeeding years. In their fourth year, 35 per cent of the female spawn; in their fifth year, 87 per cent; and in their sixth year, practically all. Many of the males spawn in their third year, more in their fourth, and all in their fifth. Spawning takes place in both fresh and brackish water of the region adjacent to Suisun Bay, and many miles up the Sacramento and San Joaquin river country. Each female has one spawning period each year, producing then from 500,000 to 2,500,000 eggs. Other phases of the life history also are discussed, such as migrations, racial composition and food of the bass.

Part III applies the findings of Parts I and II to the commercial catch. The effect of commercial fishing on the population is discussed in some detail. The principal conclusion drawn here is that because of the size of mesh in the nets, the commercial catch is made up mostly of from five to six-year-old fish. The paper closes with a review of legislative measures designed to protect the bass, and sets forth recommendations for a future policy. Aside from their value to the California legislative body, and for their scientific interest, the striped bass reports should provide a satisfactory check on enthusiasts who believe the bass population doomed, and who, from observations made on a few fishing trips, make overhasty conclusions, and agitate for drastic, often poorly planned laws. To these people, Longfellow's famous line is appropriate, "For things are not what they seem."

The Commercial Fish Catch of California for the Year 1929.

Third in an annual series of publications on the commercial fisheries designed in an effort to present a popular version of the State's catch statistics, Fish Bulletin 30, "The Commercial Fish Catch of California for the Year 1929," has just come from the press. From an historical as well as a statistical viewpoint these bulletins are increasing in value and interest with each succeeding year. It is regrettable that this one, the data for which were compiled and ready for publication over a year ago, could not have reached the public at an earlier date. New phases of the commercial fisheries statistics have been presented in this bulletin. Records which have a direct bearing on the catch, such as statistical data on the fishing boats, and estimated values of the marine products have been given.

Tables and figures are provided for mathematicians. Charts and graphs bring out the highlights in these somber statistics, thus giving a bird's-eye view for the hurried reader of the rise and fall of the important species. Finally as a new innovation in the series, well-chosen photographs illustrate the salient points in the main articles, which give past as well as current information.

Of particular interest among the articles on the general welfare of the State's marine resources is one by Mr. C. B. Tendick, Agent of the United States Bureau of Fisheries, entitled "The Value of the Commercial Fishery Products in California." The California State Fisheries Laboratory staff members have given individual species attention from the following angles: California sardine landings have been

compared with those of five foreign nations. The reasons for and the results of the expansion of the tuna fishing areas are given. The skyrocketing in the last few years of the mackerel with its more recent inclination to fall off is explained. Interesting facts are brought out about what is being done by the three Pacific coast states and the two governments concerned with our fast disappearing salmon. The romance of the Alaska codfish fishery, which directly concerns California since the bulk of it is cured and marketed from this State, will interest the old-timers. Both sportsmen and the commercial fishing interests will find that the story of the yellowtail, and that of the cabrilla from Mexico which is fast coming into the limelight, contain food for thought. Abalone, although of lesser commercial importance, is nevertheless of much interest to the general public. A review of the operations in the abalone fisheries of both California and Mexico should meet with approval.

Directly influencing the commercial catch, developing new grounds and in turn being developed themselves to suit the needs of the fisheries, the fishing craft have been featured in this bulletin. The census of the fishing boats covers the individual fishing regions as well as the entire State, and excellent photographs of at least fifteen of the different types of fishing boats lend interest to the statistical record.

Studies of the Length Frequencies of the California Sardine.

That the sizes of sardines caught by the California fishermen vary from year to year is demonstrated in Fish Bulletin 31, "Studies of the Length Frequencies of the California Sardine," recently issued by the California State Fisheries Laboratory. This bulletin contains two articles, "Dominant Size-Groups and Their Influence in the Fishery for the California Sardine," by Frances N. Clark, and "The Commercial Catch of Adult California Sardines at San Diego," by H. C. Godsil.

The chief cause of the change in size of fish in the catch is the presence of dominant groups. This dominance is presumably brought about by favorable environmental conditions in certain seasons which result in an unusually large number of fish surviving through the first year. When a superabundant group first enters the commercial catch the average size of fish in the catch is small, and as the individuals of the dominant group increase in size from year to year the average shows a corresponding increase. This increase of the average size of the fish is accompanied by a decrease in the numbers of fish packed in a "pound-oval" can.

The same dominant groups have appeared at Monterey and San Pedro and passed through the fishery at each port in a similar manner. The fishery at San Diego for pound-ovals is much more restricted than at Monterey or San Pedro, but the data indicate that the same superabundant groups are present in the San Diego fishery also.

The behavior of three dominant groups which passed through the California fishery between 1919 and 1930 is used as a basis for the prediction of the fate of the superabundant class which entered the fishery in 1929-1930. This group should influence the fishery until 1933-1934, causing small fish to dominate the catch in 1930-1931 and increasingly larger fish in succeeding years. The catch for 1930-1931 at both Monterey and San Pedro was comprised of the predicted sizes and the accuracy of the later predictions will be awaited with interest.

SACRAMENTO PERCH

By GEORGE NEALE

(With three photographs by author)

THE SACRAMENTO PERCH (*Archoplites interruptus*) is but little known or even recognized by the younger generation of anglers. Dr. David Starr Jordan says, "It is a large and gamy fish, valued and interesting as being the only fresh water fish of the nature of perch or bass, native to the west of the Rocky Mountains." It is said that their numbers have been greatly reduced by the perch eating the catfish and their stomachs being torn by the sharp pectoral fins. To some extent, this may be true, but it is the opinion of the writer, who has known these fish intimately for more than forty years, that the depletion is caused by the catfish and carp eating the spawn of the perch.

I have made some interesting experiments with the egg of spawn-eating fishes. Of course all the experiments have been made in an



Fig. 114. Sacramento perch recently rescued from Lake Chabot were planted in this fine propagating pond near Sacramento. Picture shows north end of lake.

aquarium and those fish which ate may have been forced by hunger to do so. The black basses and crappies will starve before they will eat spawn, but it has been demonstrated that carp, catfish and bluegill will eat the spawn.

The spawning habits of the Sacramento perch are unlike the black bass, which prepare their nest on the sand or mud at the bottom. This particular perch spawns among the aquatic growth, old limbs of trees and branches sunk in the water. My experience with these fish is that they are less aggressive and pugnacious at the spawning time in protecting their spawn and young than are the bass and some others of the spiny-rayed tribe of fresh-water fish. Consequently, the spawn is more or less unprotected during the spawning period.

Before the introduction of the carp and catfish into our waters, and in spite of the fact that many tons of Sacramento perch were netted and marketed every year, they more than held their own, and, strange as it may sound, were, with the exception of the salmon and trout, the only game fish in our valley waters. In the year 1890 or before, the introduced fishes became numerous, Tulare Lake in Kings County, Duck, Prospect and Sycamore sloughs, in Yolo County, Butte Creek and many other waters of Sutter County were thickly populated with them.

The Bureau of Fish Rescue recently rescued 200 Sacramento perch from Lake Chabot. These fish averaged from two and one-half to

four pounds each in weight. They were all transported, alive, to Sacramento, where two fine lakes donated by a friend were prepared for them. It is the intention of W. H. Shebley, in charge of the Bureau of Fish Culture, and the writer to propagate them and to endeavor to rehabilitate them by stocking waters that do not contain spawn-eating fish. In 1910, the writer and Deputy M. L. Cross were instructed by the Fish and Game Commission to make distribution of black bass from Lake Chabot. This we did, making, in all, 240 shipments from Los Angeles to Siskiyou. The only fish netted in the lake were black bass and Sacramento perch. No other fish were present. In our rescue work last July, there were no other fish present except *Gambusia* or mosquito minnow. This accounts for the perch being so numerous, for the reason that black bass do not prey upon spawn,

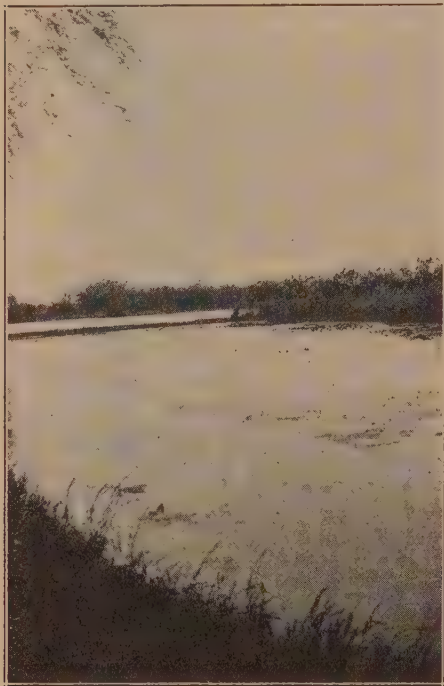


Fig. 115. South end of perch propagating pond near Sacramento. Note the levee dividing the middle pond.

but will eat the young of most any species, including its own. Examination of the stomach contents of both bass and perch showed nothing but small *Gambusia*, both of the other species being too large for them to swallow. We also learned that a large majority of the perch had not yet spawned. It is possible that we may raise a large number this season. They are now perfectly contented in their new home, with their diet of *Gambusia*, with which they are being fed. Naturally, they are a river or stream fish, but with the era of hydraulic mining filling the rivers with silt, their last chance to exist is in the inland lakes, of which there are many.

For table use, they are the peer of all the spiny-rayed tribe of fishes.



Fig. 116. A fine six-inch stream of water, 60 degrees in temperature, feeds all three perch propagating ponds near Sacramento. Mrs. George Neale is standing by the cement inlet trough. The water is very clear.

SOME PROTECTED BIRDS THE DUCK HUNTER SHOULD KNOW

By JAMES MOFFITT

THIS article has been prepared for the duck hunter to draw his attention to some protected birds he should avoid shooting and to assist him in identifying these species in life. All of the birds treated here are especially protected by State or Federal laws, or by both, on account of their scarcity. Many of them are innocently or wantonly killed each gunning season by hunters who are either uninformed or heedless of their protection.

White-tailed Kite (*Elanus leucurus majusculus*). This beautiful hawk was once abundant over most California lowlands, but its numbers were severely reduced even forty years ago, chiefly by wanton shooting. It is a handsome and conspicuous bird with gentle or trustful habits which accounted for its depletion. Marshes are favorite feeding grounds for kites and they ordinarily pursue their food, mice and insects, by harrying back and forth over such areas. They usually fly at low elevations and thus afford conspicuous targets to hunters who occasionally try their aim at them when better prey is scarce. This habit was no doubt the greatest contributing factor to their almost extinction 25 years ago. The white-tailed kite was given absolute protection in California in 1905, which it has since enjoyed even to the extent that scientific collectors are not permitted to take it or its eggs. Despite this protection, the birds have, at best, been slow to respond and they are now but fairly numerous in favored localities where originally abundant. No doubt the main reason kites have not increased more rapidly is the fact that some are still killed each shooting season by thoughtless sportsmen.

It is indeed a pity to kill this unique and beautiful bird. In addition to being a most interesting member of our avifauna, the kite is one of our most beneficial species. Some hawks that are generally considered beneficial occasionally prey on other species considered friendly to man's interests, but are classed as beneficial because the majority of their prey consists of harmful varieties. Not so with the kite. I know of no smudge against its bill of fare which appears to consist wholly of species inimical to man's interests. Its diet is made up of mice, lizards, crickets, grasshoppers and other similar pests.

The white-tailed kite, a member of the hawk family, is a slender bodied, long-winged bird some 16 to 17 inches in length. More often seen in flight than at rest, it sails so lightly on its long wings, it resembles a sea gull more than a hawk. Its upper plumage is deep pearl gray in the adult, paling on the head and toward the tail, which is white except for the two central gray feathers. The wings are deep pearl-gray above, except for large, black shoulder patches. Beneath they are white out to the "elbow" where characteristic black spots or "mirrors" exist. The primary flight feathers, forming the tips of the

wings are gray. The bill proper is black, but the basal skin is yellow as are the feet and legs.

Donald D. McLean, field naturalist of the Bureau of Game Refuges, has prepared some pencil sketches showing characteristic attitudes of the white-tailed kite that are reproduced herewith. Fig. 117A shows a ventral aspect of the bird as it appears when sailing overhead. The

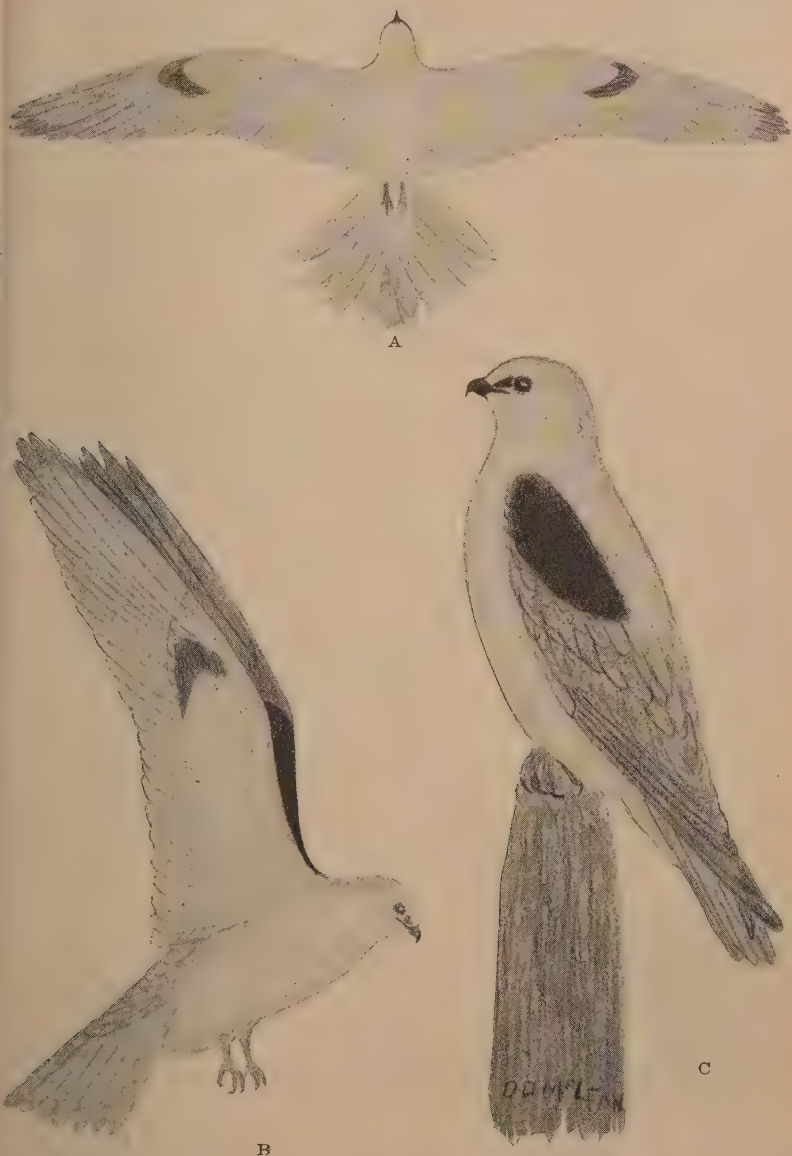


Fig. 117. Pencil sketches of the white-tailed kite. A, soaring flight; B, hovering pose; C, perched at rest. Drawings by D. D. McLean.

rounded white tail, clear white under surface and the black "mirror" near the bend of the wings are characters to identify it.

Fig. 117B shows the bird in the characteristic hovering pose. This attitude is distinctive of the species. Kites sail over marshes as pictured in Fig. 117A in search of food. When favored localities are reached the birds check their flight by hovering with highly arched wings, which are flapped rapidly, holding them almost or quite stationary in the air while they inspect the ground below for food. The hovering ordinarily occurs about 60 feet above the ground, but may vary from 25 to 100 feet elevation. If prey is located, kites descend vertically, at moderate speed, with wings still highly arched but rigid, to seize their victims. Anyone doubting the nature of kites' food need only note their small, weak feet and legs, which are obviously unsuited to cope with anything but the smallest prey.

Fig. 117C shows a kite at rest. The birds are not often seen in this pose by the hunters as they are more frequently awing, when on the marshes. They do, however, occasionally rest on the tops of such trees as may grow in the vicinity, on posts, or even on high tule. I have seen as many as 11 at rest in a group on thick tule.

The only bird a hunter might reasonably confuse with a white-tailed kite is the adult male marsh hawk. The latter is, however, a larger species measuring from $17\frac{1}{2}$ to 20 inches in length. It frequents marshes like the kite but does not indulge in the hovering flight of the former. The male marsh hawk is blue-gray above and mixed white and reddish below. It shows some gray on the underside of the neck and chest and is altogether a darker appearing bird than the kite. It has a much longer, slimmer tail than the kite and its wings are rounder and more upturned at their points. This species usually flies closer to the ground than kites and glides over the marshes with frequent turns and dips. Young male and female marsh hawks of all ages, are mainly brown in plumage, except for a conspicuous white patch at the upper base of the tail, and can not be confused with kites in any plumage. In any event, marsh hawks are protected in California and may not be killed legally. Therefore the duck hunter has no excuse to offer when he claims he thought the kite he shot was a marsh hawk.

The duck hawk is the only hawk a hunter is likely to see on our marshes that he may kill legally. It is a relatively rare species in California and certainly few are killed in proportion to the beneficial hawks that hunters destroy, many perhaps in the belief they are duck hawks simply because they are found on marshes. The duck hawk can usually be recognized by its extremely swift flight, accomplished by vibrating its sharply pointed wings very rapidly, through a short stroke. In size it resembles the marsh hawk, though it is of heavier build throughout. Its plumage is mainly dark brown, with lighter, freckled under-surface. Old birds are dark bluish-gray above. Cooper and sharp-shinned hawks, the only other members of the family that are considered predacious and may be legally killed in California at any time are usually confined to forest or brush lands and are seldom found on our marshes.

Wood Duck (*Lampronessa sponsa*). Most duck hunters are aware that this beautiful bird is protected by both Federal and State laws at

all times and few if any would knowingly kill it. The gaily colored plumage of the male wood duck is so conspicuous and well known to practically all sportsmen that a description of it seems unnecessary. A photograph of a mounted specimen was reproduced in the October, 1930, number of CALIFORNIA FISH AND GAME (Vol. 16, p. 341).

It is more difficult to distinguish the female wood duck from certain other species and some are killed each shooting season by hunters who fail to identify them until too late. Like most ducks, the female of this species wears much duller plumage than the male and is mostly plain brown in color. At close range, the brown crested head with ring of white feathers surrounding the eye and the white throat patch are good marks for identification. However, the hunter will frequently not have close enough view of the wood duck to note these features and will probably most often encounter it in flight. Here, particularly when viewed from below, rather than from the side when the crest can be noted, the bird may resemble the females of the widgeon (baldpate) or the gadwall. The females of these three ducks are about the same size and are the only female fresh water ducks occurring in California that have clear white underparts. Both the female widgeon and gadwall have white bars on their wings that show conspicuously in flight while the female wood duck's wings are entirely dark in color. The white "speculum" (mid wing patch) of the female gadwall plus its orange-yellow feet and legs and general "mallard-like" appearance, serve to distinguish this rather scarce California duck from the wood duck, which has dull yellow, almost brown feet and legs. The female widgeon has an almost pure white underwing surface that is very conspicuous in flight. Therefore, in order to be on the safe side, a hunter should not shoot a medium-sized, plain brown duck with pure white underparts, unless it shows white on its wings in flight. Another distinctive feature of the female wood duck is its long rounded tail which appears to be twice as large as that of either the gadwall or widgeon.

Perhaps the best recognition mark of all for the female wood duck is its habit of calling characteristically in flight. When startled or flushed it usually utters a high-pitched quavering *hoe-eeek* or *oe-eeek* which is frequently repeated in flight. No other ducks render a similar call.

There are certain localities where hunters should be particularly watchful for wood ducks. This species is usually found where trees are growing adjacent to water. Willow and cottonwood bordered sloughs in the interior valleys are favorite haunts of this bird. It also frequents creeks, streams or lakes that are margined by oaks and is often found perched in oak trees where acorns form a favored food for it. Wood ducks do not ordinarily frequent open marshes or ponds where hunters need not be apprehensive over accidentally killing them; but sportsmen who are shooting near trees, often favorite spots for mallard, should ever be watchful for this species.

Ross Goose (*Exanthemops rossi*). This and the following species were accorded complete protection in the United States by amendment to the Federal Migratory Bird Treaty Act on March 17, 1931. The Ross goose, also termed Ross snow goose and sometimes China brant, is the only North American bird whose breeding range is entirely unknown. It nests somewhere in the extensive Arctic lands north of

the Athabaska-Mackenzie region of Canada through which it travels each spring and fall migration. Its winter range lies almost wholly within California where it is chiefly found in the Sacramento and San Joaquin valleys. Ross geese were originally abundant winter visitants to our central valleys, but have always been far less numerous than the larger lesser snow geese. Like other geese, Ross geese were greatly reduced in numbers by market hunting before this became illegal and they are now comparatively scarce. In order to preserve this unique bird, it was given complete protection and since almost all Ross geese winter in California, it is up to us to see that the species is perpetuated.

The Ross goose is one of our smallest geese, adults varying from 22 to 26 inches in length from bill to tail-tips, and weigh from $2\frac{1}{2}$ to $3\frac{3}{4}$

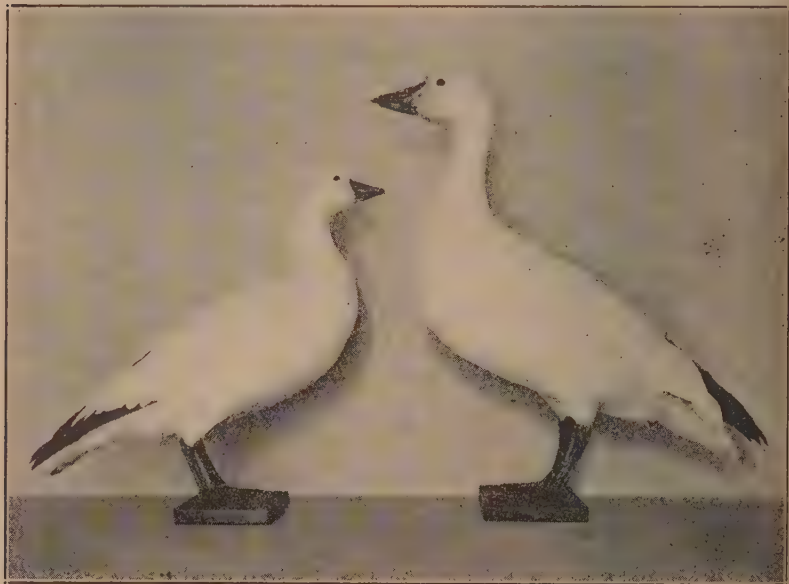


Fig. 118. Adult Ross (left) and lesser snow geese. Photograph of mounted specimens in Chase Littlejohn collection. Photo by author.

pounds, averaging about 3 pounds. Its body is little larger than that of a mallard duck, but it appears larger in flight on account of its longer wings, tail and neck. Male Ross geese, like other geese, average slightly larger than females. Fig. 118 shows a mounted specimen of an adult male Ross goose in contrast with a lesser snow goose of the same age and sex. The latter species which weighs from 4 to $5\frac{3}{4}$ pounds, is well known to most California hunters and the photograph shows the small size of the Ross goose in comparison. Both birds are pure white in plumage except for black primary flight feathers or wing tips. Sometimes the feathers of the head and neck, particularly those near the bill, and underparts are rusty or reddish. This is caused by a deposit of iron oxide derived from water containing this mineral that the birds feed in and occurs more often and to a greater extent in the lesser snow goose than in the smaller species. The bills and feet and

legs of both species are bright pink in color. The Ross goose differs from the lesser snow goose chiefly in size, but it also has proportionately longer legs and shorter neck and bill. Adult Ross geese, particularly old males, have warty protuberances known as caruncles at the base of the upper bill that are somewhat like small turkey wattles. These are characteristic of the species and never occur in the lesser snow goose.

The hunter will most frequently encounter the Ross goose in flight where it is rather difficult to distinguish from the lesser snow goose. When Ross geese first arrive in California in the fall (October), they are in large flocks all of this species. These aggregations soon break up and later in the season the smaller birds are often mixed in flocks with lesser snow geese. When a flock contains both species, the smaller birds may be distinguished by their size and comparatively short necks. Another distinction between the two species is voice. The loud call of the lesser snow goose is too well known to California hunters to warrant a description here. The call of the Ross goose is entirely different. This species has no loud or shrill call and utters only a simple grunt like *kug* or weak *kek kek* or *ke-gak, ke-gak*. Once heard this call is readily recognized again and is very distinctive of the species for no other California goose utters a similar note.

Nothing in habits or manner of flight will serve to distinguish these two species, unless it be the Ross goose's custom of darting in flock formation from a height to a lower level and their slightly more erratic flight. Ross geese do not decoy well and entire flocks of this species seldom "work" in close to either live or "dummy" decoys. When mixed in flocks with lesser snow geese, however, the smaller birds often accompany the larger ones into decoy stands.

The young Ross goose is quite similar to the adult except that its back and top and sides of head are ashy gray and its secondary or inner flight feathers are dark centrally. The young of this species are never as dark as juvenile lesser snow geese.

Cackling Goose (*Branta canadensis minima*). This bird is better known to most California hunters as the "little brant" or "yelper." It is a very abundant winter visitant to the Sacramento and San Joaquin valleys and is also numerous at Tule Lake and other points in northeastern California until driven out by severe weather in mid-winter. It is not common at any season in southern California and most of these birds do not apparently go farther south than the San Joaquin Valley. In point of numbers this is probably the most abundant goose wintering in California and local sportsmen do not understand why it was given absolute protection by the recent Federal amendment. The reason is that this bird, like the Ross goose, winters almost exclusively in California, where its numbers, even though still large, have been greatly reduced, and a closed season for a period at least was considered necessary to preserve the species.

Cackling geese nest in a rather restricted region along the Behring Sea coast of Alaska from the Aleutian Islands north at least to the Seward peninsula. In migration they pass through Oregon and Washington where some were killed each fall, but nearly all seem ultimately to winter in our central valleys. The bird does not occur east of western Nevada or eastern Oregon and Washington except as a stray. Little brant reach California in mid-October and are numerous from early November until April. More cackling geese were killed each hunting

season by commercial goose hunting stands in the Sacramento valley than all other species combined throughout the whole State. This kind of goose shooting over large bands of live decoys with batteries of hunters in a line of pits has been modified so by recent State and Federal laws that killing large numbers of geese over decoys will probably never occur again in California. It is now illegal to use more than 10 live goose decoys to a stand and special State and Federal permits must be obtained to possess the decoys. Commercial clubs are prohibited from shooting more than two hunters from a blind and blinds must be at least 80 yards apart under recent State law. These regulations, plus the reduced Federal limit of four geese per day and eight per week, should afford sufficient protection to cackling geese to preserve the species should the season be opened on them in the future.



Fig. 119. Adult male Hutchins goose. Photograph of mounted specimen in Chase Littlejohn collection. Photo by author.

Hunters and even ornithologists have considerable difficulty in distinguishing the cackling goose, or little brant, from the Hutchins goose which they more frequently term the big brant. These two birds have generally been considered subspecies of the Canada goose, or honker (*Branta canadensis canadensis*). All three are quite similarly marked and size and voice are the main respects in which they differ. Most hunters are thoroughly familiar with the honker, our largest goose, which seldom weighs less than eight pounds. Canada geese average about 10 pounds in weight and large individuals have been recorded as weighing at least up to 17 pounds. They are readily distinguished by their size and are seldom or never confused with the smaller Hutchins goose.

Fig. 119 depicts an adult Hutchins goose of average size and markings. Considerable variation exists within this subspecies and

some individuals are darker ventrally than the specimen figured. This form is ordinarily 25 to 29 inches in length but occasional individuals even exceed these measurements. Their weight varies from four to six pounds.

The cackling goose is a smaller bird than the Hutchins goose and is almost a counterpart of the Ross goose in size and weight. Cackling geese weigh from $2\frac{1}{2}$ to $3\frac{3}{4}$ pounds and measure from 22 to 25 inches in length. They are generally marked like Canada and Hutchins



Fig. 120. Adult male Hutchins (left) and cackling geese. Photo of scientific skins in the author's collection. Photo by author.

geese, but average much darker in color ventrally. Adult cackling geese are deep grayish-cinnamon brown below, but young birds are lighter in color and some are as light as Hutchins geese on the under surface. The backs of old cackling geese are bluish-gray brown in color, rather than dark brown barred with lighter brown as in the Hutchins goose. Again this distinction is not shared by juvenile birds and young cackling geese have almost as dark upper plumage as their larger relatives. The bill of the little brant is very short and averages but an inch and a quarter in length, while that of the Hutchins goose is usually over an inch and a half in

length. Most of these differences, except size, are impossible to distinguish in life, particularly in flight. Fig. 120 shows typical adult males of the two subspecies, and illustrates their comparative sizes. Note that the lighter under surface of the Hutchins goose commences abruptly behind the black neck, while the darker underparts of the cackling goose blend gradually into the black neck, behind the white collar. This white band around the base of the black neck is a variable feature in both subspecies, and may or may not occur. The continuity of the white cheek patches around the throat or their separation by a

black throat band of variable width is another feature common to individuals of both subspecies and therefore worthless for identification purposes.

Distinctions that will serve to identify the subspecies in flight are what sportsmen are most concerned in and while such differences exist, they are difficult to convey in words. Once a hunter of average perception has these characters pointed out to him in the field he will have little difficulty in separating the birds in future, but I am not confident that they can be conveyed in writing.

The birds differ in manner of flight and in appearance. The Hutchins goose gives the impression of being a rather long-necked bird and it progresses with relatively slow and short wing beats. Its wings do not appear to be particularly long in comparison with the bird's size, nor noticeably pointed. Its flight may be termed rather "heavy" compared with that of the little brant. The cackling goose has comparatively longer, more pointed wings which are flapped more rapidly and through a longer stroke than those of the big brant. Its flight seems lighter and less laborious than the larger birds and it is a more active bird in the air. The little brant's neck appears shorter in relation to its body than the larger ones, but this does not give the cackling goose a "chunky" appearance as might be expected, as it is offset by the bird's relatively greater wing length.

Voice or call notes serve best to distinguish these two geese in the field. The call of the cackling goose is much higher pitched and shriller than that of the big brant. The smaller bird also utters some notes that are not even simulated by the larger one. Bird voices are at best poorly imitated by written word and it is particularly difficult to attempt to convey an impression of goose calls here. However, the following syllables may aid some readers in recognizing the cries of these birds. The cackling goose in flight most often utters a yelping *yelk*, *yelk*, *a-lick*, *a-lick* or *lick*, *lick*, *lick*. Hutchins geese have lower toned, deeper voices and render notes that might be written *lo-ank*, *lo-ank*, *a-lank*, *a-lank* or even *lo-unk*, *lo-unk*.

The best way of surely learning how to distinguish these two geese in the field is to have someone familiar with the differences point them out in life. Once seen or heard, they will readily serve to identify most individuals that may be encountered, and, in fact, the voice and flight characters are quite as pronounced differences between cackling and Hutchins geese, as are other characters to be noted with the birds in hand.

THE PROPAGATION OF CALIFORNIA QUAIL IN OPEN BREEDING GROUNDS

By WALTER R. WELCH

The following editorial was published in the Oakland, California, *Tribune*, August 20, 1931:

"INVITING HIM BACK

"California has named the Quail the State bird. New York is bemoaning the fact that Bob White Quail, once so numerous, is almost extinct, and is taking means to remedy the situation.

"The State Conservation Department there has ordered from a breeder in Virginia 3400 quail to be distributed for propagation in various parts of New York. It is explained that the greatest enemy to the quail in the Empire State is not the hard winter, but the rapacity of the pot hunter.

"Virginia, the state which is furnishing New York with quail, had a similar experience. Its Game Commission lent its support to systematic attempts to arrest the decline of the birds, and one man, William B. Coleman, conducted a successful attempt in breeding the birds in captivity. Within ten years he released approximately 20,000 birds.

"So anxious is New York to get the quail back, farmers and sportsmen have promised to cooperate with the Conservation Department. Grain is to be left in the fields for the birds to feed upon, and supplementary food supplies are to be provided when winters are severe. New York did not realize how much it valued Bob White until he had departed."

When we take into consideration the fact that California has an area of 157,297 square miles, and a coast line more than 1000 miles in length, and that this area in square miles is equal to the area of all of the New England states, with New York, New Jersey and Pennsylvania added, we can realize that if it required ten years to propagate 20,000 quail in captivity to be used for restocking the game fields of Virginia with quail, how long it would take to propagate in captivity a sufficient number of quail to restock the game fields of California.

Among the most important of all of the game birds native to the State of California, and the birds to which the sportsmen of this State are most deeply indebted for their sport afield with dog and gun, are, in my humble opinion, the Valley and Mountain Quail. These birds, which test not only the skill of the hunter, but the good qualities of his dog, are to be found on the farms and in the fields, in the valleys and on the hills, in the desert, in the wilderness of the forests, and on the mountain sides and peaks throughout the entire State.

They are the friend and helper of the farmer, orchardist and vineyardist, the companion of mankind, and well merit being called the 'Plumed Knight of the Chaparral,' and selected by the Legislature as the bird to represent the State of California.

While at one time Valley and Mountain Quail were to be found in countless thousands throughout the entire State, during the past decade their ranks have been so greatly reduced that at the present time there remains only a remnant of the once bountiful supply of these beautiful, as well as game birds.

How to maintain, if not increase the present supply of these native game birds is a problem that the Fish and Game Commission, as well as the sportsmen and the people of California are endeavoring to solve.

As the matter of reestablishing the supply of native game birds is one that has been and is being given considerable attention in many of the states at this time, and as many theories have been and are being advanced along those lines, it might be well to briefly mention some of them prior to outlining the system that is being undertaken in this State in an effort to reestablish the supply of quail, and to solve the quail problem in California.

Some of the eastern states in an effort to reestablish the supply of native Bob White Quail have adopted a system of propagating quail by the use of electric incubators on State game farms. This system has



Fig. 121. Quail generally seek water twice a day—morning and evening. Hunters often destroy the birds by pot hunting at the water holes. Here is a fine watering place at Whitewater where the birds are now protected through the sanctuary system. Photo through courtesy of W. A. Roth, August, 1931.

proven to be fairly successful, but it involves a great deal of work, care and considerable expense, with the result that it costs the State from \$2 to \$7 for each quail thus propagated.

Another system that has been adopted by some of the states, also with some measure of success, is that of propagating quail through natural channels in open breeding grounds.

Under this system the state leases large tracts of land that are adapted to quail, where the quail raise themselves under natural conditions, the surplus birds being trapped and distributed a few pair here and a few pair there, to restock the shot-out lands of the farmers. Under this system it has been found that the quail can be raised by the state at a cost of about 50 cents each.

Among other systems that have been adopted by some of the states in an effort to maintain, if not increase the supply of native game birds and animals, and one that has met with some degree of success, is that of encouraging farmers and landowners to consider a

supply of game an asset, and a means of deriving a revenue from their property by charging sportsmen a fee for the privilege of hunting and shooting on their lands, or renting their lands to hunters the maximum fee per day or per acre that can be collected by the landowner being fixed by State law.

This system appears to be working out satisfactorily and beneficially to the interest of all parties concerned in the state of Texas at the present time.

To protect quail in California, the present State law provides for an open season between November 15th and December 15th in all districts except in district 1 $\frac{1}{2}$, in which district the open season is between November 1st and December 31st; provides for a daily bag limit of 15 and a weekly bag limit of 30 valley quail, and a daily bag limit of 10, and a weekly bag limit of 20 mountain quail, and prohibits the trapping or sale of any quail at any time.



Fig. 122. Hunters camp at this location but are prevented from shooting on the sanctuary ground by a system of "warning" signs. This is excellent country for the propagation of quail. Photo through courtesy of W. A. Roth, August, 1931.

Coupled with the protection afforded quail under the State law, and in an effort to maintain, if not increase the supply of quail and to solve the quail problem, the Fish and Game Commission of California is propagating quail by the use of electric incubators installed at the State Game Farms located at Yountville and Chino, and have also established two suitable State quail refuges in the southern part of the State, where quail will be propagated through natural channels on open breeding grounds.

On one of these State quail refuges the birds will be supplied with ample water, feed and cover, and every attempt made to keep the birds free from disease, and to afford them protection against attack by hunters, and all birds and mammals considered to be the enemies of quail.

On the other State quail refuge, aside from seeing that the birds are able to secure water and feed, and that they are not molested or disturbed by hunters, no attempt will be made in the way of predatory bird and mammal control on the refuge, and the birds left to propagate themselves on the refuge under natural conditions.

Under this system the Commission hopes to be able to determine many important matters, and to secure much important information relative to what method it will be advisable to adopt in propagating quail with which to restock the depleted areas, and in solving the quail problem.

In conjunction with the work being done by the Division of Fish and Game to propagate quail with which to restock the depleted areas, and in an effort to maintain, if not increase the supply of quail within the State through natural channels in open breeding grounds, from the nucleus of wild quail now in the field, the Fish and Game Commission



Fig. 123. One of the boundary lines of a quail sanctuary established at Whitewater. Note the "warning" sign on the small tree at the left in the picture. Photo through courtesy of W. A. Roth, August, 1931.

is conducting a campaign for the voluntary establishment of inviolate quail sanctuaries and game refuges by farmers and ranchers on their lands.

This campaign, which is being conducted by the Commission solely through the medium of the volunteer deputies of the Division, and the members of the various fish and game protective associations and clubs sponsoring their appointment, has met with the spontaneous cooperation and support of farmers, ranchers and landowners throughout the State, with the result that during the past year upwards of 1000 inviolate quail sanctuaries and game refuges have been established within the State.

These quail sanctuaries and game refuges are located in nearly every county in the State from Modoc to San Diego, and contain about 600,000 acres of land, upon which it is estimated there are at this time about 300,000 wild Valley and Mountain quail.

In establishing quail sanctuaries and game refuges on their lands in cooperation with the movement being conducted by the volunteer deputies of the Division of Fish and Game for the reestablishment of the supply of quail, the landowner enters into a so-called "Gentlemen's Agreement" to the effect that he will set aside certain parts of his land as an inviolate quail sanctuary and game refuge, and that he will not hunt or shoot, or allow any hunting or shooting to be done on the area thus closed, for a period of three years.

With this understanding, the volunteer deputies through the association or club sponsoring their appointment, supply the landowner with proper notices for posting the closed area, and assist him in developing water and feed for the quail on the sanctuary, and in protecting them against attack by predatory birds and animals, pot-hunters and poachers.

In conducting their work of predatory bird and mammal control on quail sanctuaries and game refuges, the volunteer deputies of the Division of Fish and Game, between January 1 and July 1, 1931, have destroyed the following number of birds and mammals that are considered to be enemies of quail: 38 coyotes, 33 bob cats, 684 house cats, 35 foxes, 43 coons, 8 weasels, 2 opossums, 1 badger, 5 wild and unclaimed dogs found destroying deer and the nests of quail, 365 sharp-shinned and cooper hawks, 3972 blue jays, 293 magpies, 81 crows, 49 butcher birds, 2 great horned owls, and 47 snakes.

The reports received from the game fields during recent months indicate that in spite of this having been a dry year, late and cold rains, and cloud bursts in some sections of the State, the quail have bred well, the broods of young birds have been large, and that there is a decided and noticeable increase in the supply of quail on the quail sanctuaries in every part of the State, all of which conclusively supports the contention that there is no game bird that will more kindly or quickly respond to protection than our native Valley and Mountain Quail.

In areas where they are afforded proper protection, water, feed and cover, and are not molested or disturbed, they become very tame and can be seen along the road side or wherever proper cover is near, and will build their nests in old straw sheds and hay barns, and also in gardens, near dwellings, where they become almost as gentle as the domestic fowl.

PLACE NAMES OF FAMOUS SHOOTING PONDS

By W. W. RICHARDS

THE LARGEST closed body of water in Marin County is what is known as the Roos Pond on the Allegra Preserve near Teal Station. Way back in the early seventies, this famous pond was known as the Sixth-Reach Pond, it being just opposite the sixth reach of the Suisun Slough from its mouth where it flows into Suisun Bay.

On the Teal Club, we have the old Smith Pond, which was famous for its canvasback. This pond was named after G. Frank Smith, one of California's leading attorneys of that day.

The Titcomb Pond, also on the Teal preserve, was named after the broker here in San Francisco.

The Taylor Pond, under the Teal preserve, was named after one of the club members, Senator W. W. Taylor.

What is now known as the Tule Belle Club, owned by Charlie Joslyn, Fred Van Sicklen, Herman Oelrichs and others, was disbanded and the interests of the others were sold to Herman Oelrichs. Prior to that time, during the early seventies, these were known as the Thicket-broom ponds, after the owner of that area, including several hundred acres.

The big pond to the north and east of Cygnus Station, now owned by George Gross and Hall Richardson of Oakland, was formerly presided over and shot on during the early seventies by Captain Floyd, at one time a commander in the Confederate Navy during the Civil War.

This writer first shot on the Suisun Marsh in 1869, when there were no preserves and the ponds had no especial names, and were referred to only as "where Jim Payne shoots" or "where Seth Beckwith shoots," etc.

But in those days it was not a matter of how many ducks we could kill, so much as it was how many ducks we could get out to market.

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"There is an inspiration in the out-of-doors which is the best possible remedy for sorrow and depression, both physical and mental."—William Colby, *Sierra Club Bulletin*.

GLENN-COLUSA DECISION

California's fish screen program for the protection of food and game fishes in our streams has been materially aided by a decision in the Superior Court at Willows, Glenn County, on June 22, 1931.

The decision, made by Judge H. S. Gans, presiding in Willows, holds that the State has the right to enforce the installation and maintenance of suitable screens to prevent the fish from entering the diversion pumps of the Glenn-Colusa Irrigation District. This case has been of keen interest to those interested in the conservation of fish life and irrigation projects.

A history of the case shows that the Glenn-Colusa Irrigation District supplies water for the irrigation of 120,000 acres, more or less, in Glenn and Colusa counties. To obtain the necessary amount of water it is essential to employ large diversion pumps working in the Sacramento River. Records show that the suction of these pumps were unguarded.

The Division's attorneys maintained that large quantities of food and game fishes went through the pumps and thereby perished. As smaller water diverters in various sections of the State are required to use screens to protect fish life, the Division insisted that the large projects should be required to do likewise.

In presenting their case, the Glenn-Colusa Irrigation District maintained that the fish that went through the pumps were mostly rough species of no value, that the percentage of loss going through the pumps was small, that screens would greatly interfere with the operation of the pumps, and various other reasons.

Presenting arguments in its case, the Division produced about 6000 fish or pieces of food fishes that were taken below the pumps at the headworks of the canal and preserved as evidence. The State also argued that the greater proportion of fish that went through the pumps were killed or injured critically, that other operators have utilized fish screens for years without retarding the efficiency of the pumps, and that the cost of installing such screens would not be excessive.

Judge Gans ruled, in part: "I conclude that the evidence shows that a nuisance exists as is alleged and that it should be abated; notwithstanding the fact that the diversion is under authority of Congress and the diverter is an irrigation district under duty to serve land owners within its limits. * * * The diversion and operation of the district are required to be carried on in a lawful manner and one not damaging others or interfering with the use and enjoyment of property."

IN MEMORIAM G. H. LAMBSON

G. H. Lambson was born at New Castle, Delaware, May 11, 1863, and passed away June 1, 1931. He was one of the leading fish-culturists of the United States.

He entered the service of the Bureau of Fisheries in the car-messenger service in 1886. After a successful career in fish distribution, he was appointed superintendent of the salmon hatcheries at Baird, Battle Creek and Mill Creek, California, after the California Fish and Game Commission had transferred the Battle Creek and Mill Creek salmon stations to the then United States Fish Commission, later known as the Bureau of Fisheries.

On March 1, 1916, he was appointed superintendent of the Sisson Hatchery, later named the Mount Shasta Hatchery, succeeding W. H. Shebley, who had been appointed in 1910, superintendent of the California hatcheries and whose duties then called him from the active work at Mount Shasta Hatchery.

Mr. Lambson introduced the Chinook salmon into New Zealand in 1900. He succeeded after several attempts had been made by fish-culturists from New Zealand and several shipments of Chinook salmon eggs had been sent to that country by the New Zealand Government from the Pacific coast salmon stations.

Mr Lambson had a host of friends. He was a loyal, efficient employee and a courteous and kindly man, who held the esteem of his superiors as well as the crew that was in his employ. The Division of Fish and Game has lost, in the death of G. H. Lambson, one of its most efficient and loyal employees, and the State a good citizen and a good man.

During his fifteen years of employment by the California Fish and Game Commission, he was constantly on duty. He did not take a vacation during the entire period of his employment. The long arduous strain of his many years of devotion to his duty, had a great deal to do with his untimely death. Mr. Lambson's mother passed away, at the age of 93, three weeks before him. He had just returned from Delaware after placing his mother's remains beside those of his father, when he was suddenly stricken in his office and passed away.—W. H. S.

GAME AND FISH ON CROP BASIS IS AIM IN NATIONAL FORESTS

A continuous yield of fish and game with replenishment each season like the repetition of crops of the field, is the ideal of the the Forest Service, U. S. Department of Agriculture, for the woods and streams in the National Forests, according to the Chief Forester R. Y. Stuart.

Declaring that the total production of fish and wild life of the country is inadequate to meet the ever-increasing demand for outdoor recreation, Major Stuart sets forth the aims of the Forest Service in restoring and developing recreational and fishing opportunities.

"All National Forest land must be devoted to its most productive use for the permanent good of the whole people," he says. "That means a continuous yield of each crop the land or water is capable of producing. The Forest Service is applying this principle by harvesting the timber and forage crops on a sustained yield basis. The same principle must apply to wild life."

The National Forest program is fitting itself into public plans and the Forest Service is ready to cooperate in any sound national game program, Major Stuart says.

"The continuous yield of fish and game as a practical working principle is gaining ground," he states. "That certain species are almost extinct on some areas, that there is a satisfactory breeding stock with inadequate increase on other areas, while still other areas are overpopulated, clearly indicates the need of applying the principle on National Forests. All land and water are capable of producing some species of fish or game or fowl or fur-bearing animals or a combination of them, beneficial to mankind."

In reference to game refuges and stocked streams, he says, it is immaterial whether State or Federal agencies take the responsibilities for their regulation and productivity, so long as such areas are administered effectively. A total of 267 State game refuges, including more than 20 million acres have been established on National Forest land. These areas are administered jointly by the States and the Forest Service. In a few cases refuges have already developed an overpopulation of wild game. But generally a maximum of fish in the streams and lakes has not yet been attained. Only by hatching and releasing many millions of fish of the proper size, can the management agencies give every man his chance for a good catch.

To give the game and fish a fair opportunity it is necessary to protect the refuges from unlawful hunters and fishers, predatory animals, parasites, and also from forest fires. Fires are as fatal to fish as to animals. Loss follows from unregulated streamflow, mud, poisoning by ashes, and destruction of natural food through a combination of these conditions. The growth of public sentiment against fire has been of great help, and last year, for the first time in history, forest fires in the National Forests of the United States were kept down to a safe minimum. Continued care on the part of the millions of visitors to the National Forests will aid in attaining the hopes of the nature lover, the hunter and the fisherman.

At this time stream surveys are being made in the National Forests to determine the fish-carrying capacity of the streams, the adaptability of streams to various species, and to prevent duplication of effort. The Bureau of Fisheries and the State game and fish commissions are cooperating in gathering this information.

FOREST FIRE HAZARD

California is faced with one of the most serious fire hazard situations in many years. Fires will be quick to start and hard to control.

Hunters, anglers and motorists are presented with a rare opportunity for displaying good citizenship, but many will not respond.

There are going to be some very serious fires before the season is ended. Fish and game will suffer along with other resources. Taking past seasons as a criterion this seems inevitable and there isn't much use of trying to dodge or hide the issue.

Those who are in the field stand in a fine position to keep the loss as low as possible. The United States Forest Service gladly gives the Division full cooperation in advancing our conservation work and we can be of good service to them by furnishing them with information within our reach.

It is also possible for the Division field men to be of great assistance by helping to educate the public on out-of-door conduct. Whenever and wherever possible it would be good practice to remind hunters, anglers and motorists of the fire hazards.

Forests can be kept green and fish and game resources of the State conserved if everyone will observe a few simple rules. It is unlawful to throw lighted matches or burning tobacco from an automobile.

Leaving an unextinguished campfire is a careless folly of which no good citizen should be guilty. Those who venture into regions where fire peril exists have a greater motive for care than simply fear of the law.

It is hard to believe, sometimes, that anyone would be so foolish or thoughtless as to forget the simple rules of safety. Talk to any forest man for a short time and he will tell you some surprising things.

About the only way to teach some persons to think on a subject is to remind them constantly. Repetition is one of the secrets of radio advertising success and the habit is quite applicable in this case.

LIMIT

Only frequently, hunters and fishermen are imbued with the belief that to get the "limit" is the height of something or other, as if great laurels accompanied such accomplishments. Their idea of a "good time" is to get the limit, whether it be duck, trout, or what have you. They, apparently, never once stop to realize that game limits are not fixed on estimates of how much game one individual can properly make use of, but, instead, are really the "dead lines" beyond which game faces extinction.

In the backwoods country we still have people who do not consider themselves as amenable to and are consistent violators of our game laws. However, this much can be said for them. They take only what they can use—no more.

Persistent law violators, as they are, the question arises whether they actually kill as much game illegally, the year around, as is killed by some self-styled and limit-seeking sportsman who as persistently lets such game go to waste.

Forget the "limit"—and take only what you can reasonably hope to use. Take what birds you can use only, and practice on clay birds. Take what venison you can use, and sweeten up your marksmanship on predators or on the range. Take what fish you can use, and practice your casting on contest pools,

No greater hog exists than the game hog—he who kills for the lust of killing. Such are no better than poachers or violators of closed-season laws—they're not as good—for they waste, deliberately waste, wild game life, the conservation of which is now commanding the attention of our federal government, with millions of dollars being spent to save the game which such game hogs are deliberately wasting.

Forget the "limit"! Take no more than you can reasonably use. Spread that cry!

Another ominous fact looms up. Hunting license sales in California for 1930 shows a shrinkage of \$42,000 compared with 1929 receipts. No game, no licenses, eh! Fishing licenses increased \$40,000 for the same period.—J. H. Neustadt, *San Mateo Times*, May 2, 1931.

HOLD DOGS IN CHECK

During the past year or so a great deal of light has been cast on the depredations of the house cat in relation to our bird life. The criticism heaped on this species of domestic pet has, no doubt, been quite justifiable in most cases but in seeking solutions to the problem we should not become blinded to the acts of other members of household animal friends.

How about the dog? Is this member of the tribe of pets as spotless in the animal world as some would lead us to believe?

There is little or no doubt but what the dog creates an immense amount of damage to the wild life in a year's time. This animal may not actually do the killing in many cases but the damage is done during the chase—the pursued often receives injuries through accident that brings untold suffering and lingering death. Deer populations suffer greatly from this source.

True, efforts are made to keep these fleet canines within bounds in our forest sections through the medium of the leash or confinement. It is also true that a great deal of damage is done through ignorance on the part of owners.

Vacation time is here and hundreds of families will flock into our wooded sections for healthful recreation. Of course "Fido" is a member of the family circle and he will ride along atop the pile of canvas or on a special runningboard cage. When camp is reached he will have full sway of things and woe to any of the wild animals that come within the reach of his sensitive scent.

Perhaps a sensible campaign of education would not be amiss at this time. A few kind words of enlightenment to enthusiastic vacationists should tend to create interest in our wild living things and alleviate much suffering.

Of course, the stray dog and the lawless person who uses the dog to run game from refuges to shootable territory creates problems in a different category.

The dog as a regulated pet is a priceless asset—let's keep him so.

CONSERVATION OF WILD LIFE IN AUSTRALIA

Australia, which has had a development more or less analogous to that of the American West, is now passing through a phase also experienced in America—the realization that reckless slaughter is threatening extermination of many of its unique animal species. This is resulting in activities looking toward their protection and preservation,

The koala or "native bear," an animal looking more or less like a bear but really a marsupial related to the kangaroo and the opossum, is an object of special solicitude. In New South Wales and other regions where it had been exterminated, efforts are being made to reintroduce it.

The so-called marsupial wolf or thylacine, not so harmless and good-natured as the koala, has been mercilessly hunted and now survives only in northwest Tasmania. The Government of Tasmania has lately taken steps to protect the survivors of the species, and now forbids the exportation of thylacine pelts.

The Australian opossum is another animal that is being overhunted. In the state of Victoria alone, which has a three-months open season, at least one million are killed annually, and conservationists are becoming concerned lest the fur trade destroy itself through its own over-eagerness for profits. New South Wales is the only state where opossum is given official protection.

Although there are laws on the books to protect the native animal and plant life of Australia and Tasmania, there are not enough rangers in service to secure proper enforcement. However, voluntary assistance of interested persons is now being enlisted; and there is a movement on foot to establish nature sanctuaries and parks.—*Science*, Vol. 73, No. 1897, May 8, 1931, page 14.

REPORT AFTER GAME INVESTIGATION

"Game conservation has not yet come to grips with the fundamental causes of wild life depletion," Aldo Leopold said in a report just published on his two-year survey of game conditions in eight north central states. Presented as the first complete investigation of the kind ever undertaken, the survey covered Michigan, Wisconsin, Minnesota, Iowa, Illinois, Missouri, Indiana and Ohio.

The survey was made to discover the extent of game scarcity, the causes and possible remedies. Leopold declared, that "More game would be produced by paying the farmer a bonus on hedges and brush covers than by spending thousands of dollars a year as at present on foreign birds. The machinery is already here for the effective restoration of native game."

He said that the most important factor in the destruction of wild life is the debrushing of woodlots and drainage channels by agriculture and grazing. "The policy of modern farming is to turn every yard of land into crops or pasture. All other conservation measures are but stop-gaps until this fundamental deterioration of environment is in some way checked. The net trend of game is downward on the best soils, and will so continue unless counter forces are brought to bear upon the landowner."

As the chief remedy the investigator urged that farmers be compensated for making their land produce desirable wild life. He also urged that public ownership and management of game lands be extended while such areas are still available at low prices, and that funds for restoring nongame species be collected from general taxation, instead of from sportsmen's license fees.—*The American Field*, March 28, 1931, p. 375.

AVIATION HELPS CONSERVATION WORK

Aviation is finding its place in fish and game survey work as well as being of service in fighting forest fires and the preservation of other natural resources.

In the establishment of migratory bird refuges there is excellent use for the airplane in making surveys of the lands under consideration. Its value for such work is unlimited.

Without the use of planes it was necessary for officials of the Division to prowl around the swampy areas to ascertain the real value of the lands for the purpose. Under such a system it was almost

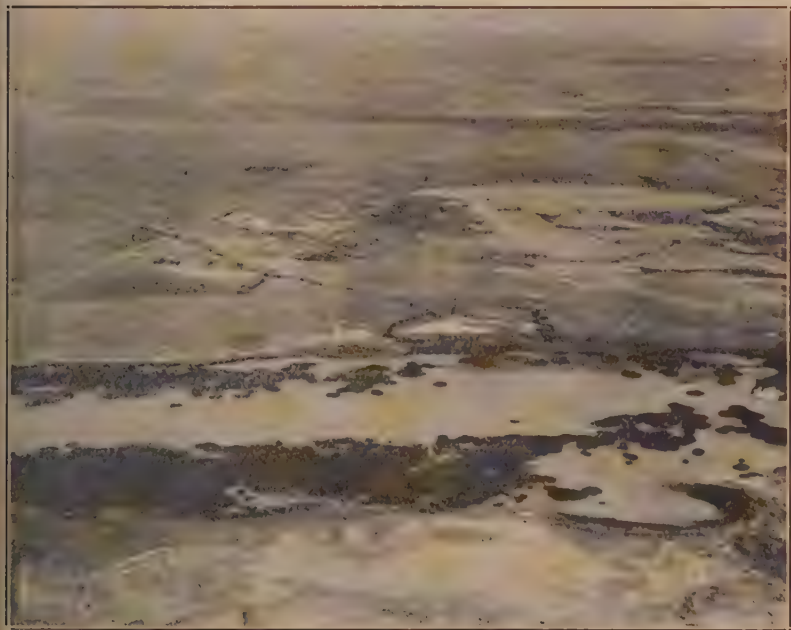


Fig. 124. Airplanes are of great service in conservation survey work. Here is a fine picture taken of some marshy area in northern California by the Governor's Advisory Committee on Game Refuges and Public Shooting Grounds.

impossible to secure necessary information without attracting local attention and defeat the purpose.

Now the conservation workers are enabled to make a quick detailed account of the proposed refuges and to take photographs if necessary. Drainage areas can be thoroughly studied and available water sources sighted.

Aside from the preliminary work the airplane is also an important actor in following the flights of birds.

Such a migratory waterfowl survey is now being planned by J. S. Hunter, director of the Bureau of Refuges, and will be completed later in the season over the State refuges in the Sacramento and San Joaquin valleys. Much important data will be gathered in this way.

SPORTSMANSHIP

Hunting and fishing rank as the greatest of out-door sports. The taking of game and fish has ceased to be a mere food-getting activity. In most sports, poor sportsmanship is punished in many ways. The boxer who hits below the belt loses the decision; the ball player who fraudulently throws a game is barred from organized baseball; the golfer who does not comply with the rules is disqualified. But in the greatest of out-door sports, hunting and fishing, unsportsmanlike acts do not meet with such unanimous disapproval. Many who never think of cheating at a game of cards, or in a game of golf, do not hesitate to take unfair advantage of their fellow hunter or fisherman in taking game out of season, or in an unlawful manner or quantity, and even boast of their unsportsmanlike deeds. Poor sportsmanship is poor sportsmanship whether displayed in golf, baseball, football or in hunting or fishing.—*Montana Wild Life*, March, 1931.

FOREST FIRES AND GAME CONSERVATION

For many years a close working arrangement has existed between the wardens of the Fish and Game Commission and the State and Federal Forest Services. Our wardens have standing instructions to assist these services in every way possible in the prevention and suppression of forest fires. There are many instances where our employees have rendered most valuable assistance to these other conservation agencies. Many of the automobiles operated by our wardens are equipped with emergency fire fighting apparatus, to make more effective the cooperation which has so long existed.

Now and then we have brought to our attention the apparent improvement in game conditions resulting from fires, but a proper analysis of these situations usually reveals that game has been forcibly concentrated in nearby unburned areas; or else after new growth has appeared in a burned area, animals have crowded in, to take advantage of the tender sprouts. Either condition results in an increased kill during a hunting season, and the erroneous impression that game is more abundant. While the new food supplied by the new growth in burned areas may seem to partly compensate for the damage done, it must be remembered that these areas are stripped of the usual protective covering, so that birds and animals are exposed to the ravages of predatory animals if the hunter does not take his toll. And if the game escapes these hazards in the crowded areas, disease finds a new opportunity to spread among the injured and fatigued animals that may have escaped the fire.

I have been told by some—of the all too many who believe in burning, that fires control beetle infestations which do so much damage. That is a question which we must leave to our forest service friends, but I can well imagine that forest fires do exterminate beetles, for they certainly do that with quail and other game. It is probably as effective a pest control method as burning a dwelling would be to rid it of moths.

Our records contain many reports of the tragedies which are found in the wake of forest, brush and grass fires. The following letter from C. S. Robinson, Sequoia National Forest, is typical:

“During the recent Robinson fire in the Kings River Canyon, with several others I was watching the advance of the flames tearing up a small ravine. The wind was strong and directly behind the fire,

so that it came shooting up in great gusts and faster than a man could run.

"Some quail flew by and a few doves, one of whom settled on the branch of a tree ahead of the fire. The poor thing was evidently completely exhausted, as in a little while, after vainly endeavoring to rise, it fluttered to the ground and, for all I know, must have perished, as the smoke was so thick I could not see where it fell.

"Three deer passed close to us; then, just ahead of the flames came a young doe, very lame. She was badly singed and her feet must have been practically roasted. She seemed bewildered, showed no signs of fear when I went towards her, and lay down near a small patch of willows. By this time the fire was almost on top of us and we had to retreat. The last thing I saw as we ran was this little doe—she had struggled to her feet, and was standing with her head down between her legs, her back to the fire. The next day I found her body where I had last seen her."

The strong maternal instinct of many birds and animals causes them to sacrifice themselves in vain attempts to protect their offspring. In every forest fire we have enacted the most pitiful of tragedies. The contemptible doe killer is an amateur of destruction as compared with that master destroyer of game—the forest fire.

Even our fish do not escape. Cool waters become heated and loaded with ash, which gathers in the gills of the fish and suffocates many of those which may survive the high temperatures, and those escaping this fate are deprived of the normal protective vegetation.

Like contagious diseases, these fires may be checked and suppressed, and like diseases, they may be mostly prevented. For the good of our game, let us save their homes. Let us prevent the torture and suffering and destruction of the birds and animals. Let us keep our forests green, our skies clear, and our game secure.—John L. Farley, Executive Officer.

GAME FISHES

DROUGHT CREATES PROBLEM

Low water in the rivers created a serious problem for the fish culturist this year. In many localities along the coastal streams the water was so low that the fish were unable to reach the egg collecting stations and it was necessary to construct temporary locations farther down the river.

It was reported that many fish spawned near the mouths of the rivers and this was given as an indication of a very poor season. The fish, however, were in good condition.

Planting activities this season were exceedingly difficult because of the drought. Many tributaries had to be eliminated in order to get the best results from the trout raised.—J. H. Vogt, 510 Russ Building, San Francisco, California.

MORE LEISURE AND MORE TROUT

Depression, unemployment, shorter working weeks and the attending results are causing many persons to think seriously on various subjects. Here is what has been said in regard to angling activities:

Official recognition that unemployment and the five-day week have contributed a new problem on the fishing streams of the country is taken by the Federal Bureau of Fisheries.

More fishermen are whipping the trout streams and lakes than ever before in history and the principal reason for the shortage of fish is the added leisure. To this situation are added the factors of better roads to trout streams and the drought in certain states.

Lewis Radcliffe, deputy commissioner of the Federal department, has issued the following statement:

"For many years, interest in angling has been growing as the sport has increased in popularity and the ease of access to the country's fishing waters has been made possible by the building of roads and the increased use of automobiles. In some sections fisherman traffic to inland lakes has grown to such an extent as to necessitate the building of all-weather roads, despite the fact that travel on these routes is otherwise negligible.

"With shorter working hours, the five and one-half day week, and the trend toward the five-day week, the increased time available for fishing has been reflected in greater demands for the stocking of streams, especially by private game clubs and by owners of small lakes and ponds where the full day's catch was formerly a certainty.

"Besides the demand from these developments on the fish supply, the drought of 1930 also took its toll in the form of dried-up streams, lowered water levels and general stagnation. The Federal Bureau of Fisheries through its various stations throughout the country, the State commissions and private hatcheries are being enlisted to replenish the loss. The Federal bureau's contributions in the way of fingerlings, fries and small fish have been somewhat less than those of the States."

Immediate enlargement of operations of fish hatcheries is necessary to keep the streams supplied with enough trout to give the average fisherman a chance at half the legal limit,

RESCUE WORK STARTED IN 1928

Although fish rescue work has not been carried on for a very long period in California it has grown to be an exceedingly important bureau, according to records at the Division.

To go back into history the Bureau of Fish Rescue and Reclamation was organized and put into operation August 1, 1928. At that time Eugene D. Bennett, now attorney for the Division, was the executive officer.



Fig. 125. Fish rescue work has grown to be an exceedingly important branch of fish and game conservation in California. George Neale, in charge of the Bureau of Fish Rescue and Reclamation (left), and helper are seen planting rescued catfish in the San Joaquin River, near Tracy. Photo by E. S. Cheney, August, 1929.

In making a study of the conservation needs in this State, Bennett called a conference with George Neale, former executive officer, according to records.

After a lengthy discussion Bennett decided to create the Bureau of Fish Rescue and Reclamation, and he appointed Neale in charge of the work. Excellent results were obtained immediately.

Neale secured the services of Abe Woodard as net foreman. Equipment consisting of various types of nets, and fish cans were obtained and a program for the enlistment of volunteer help was launched.

During the first year more than two million fish, including black bass, crappie, catfish, bluegill sunfish and green sunfish, and other species were rescued from "death" ponds and drying streams and placed in live waters. The second year the number of rescued fish jumped to a total of five million.

And, according to Neale, the number has been increasing as the volunteer interest in the work has increased. Sportsmen now realizing the importance of rescue work are more willing to assist, he said.

This year is an exceedingly important year for fish rescue work, Neale said, and during the month of May a total of 1,697,919 fish were rescued in the Sacramento Valley. These fish due to the hot weather and transportation facilities were taken to the nearest live water and released.

TROUT RESCUED EARLY

Fish rescue crews from the Division of Fish and Game are, literally, being swamped with work in various parts of the State. The fish rescue and reclamation work is directed by George Neale and comes under the supervision of the Bureau of Fish Culture.

A very large percentage of the rescued fish are of the spiny rayed tribe of fresh water game and food fishes, black and striped bass, crappies, calico bass, sunfish and several kinds of perch, catfish, etc., none of which can be or are propagated artificially as are trout and salmon.

This year, however, the drought has created many exceptions to the general rule and it has been necessary to rescue members of the trout family very early in the season. Monterey County has afforded a striking example.

Game Warden William F. Kaliher of Monterey, and a crew of workers have been very busy removing stranded steelhead to live waters. To date they have saved nearly 10,000 of these fine trout.

The crews net the fish out of the "dead" pools, place them in water tanks where they can swim about and haul them to live waters near the mouths of the streams.

In reporting on the work, Kaliher said, "We often run into pools that are too rough and deep to work, then we chart the location and return later, when the water is lower, and save the trout."

It is safe to predict that hundreds of thousands of fish will be rescued before the dry season is ended.

MANY FOOD FISH RESCUED

One of California's most characteristic game fish species long headed for extermination was given a new lease on life in July through the activities of George Neale, head of the Bureau of Fish Rescue.

Low water conditions in Lake Chabot, municipal water supply for the city of Vallejo, necessitated the rescuing of thousands of perch and black bass. When the seining operations of the fish rescue crew were started, it was found that Lake Chabot contained large numbers of adult Sacramento perch, the only native spiny-rayed freshwater game fish in California. In addition to over 2000 fish of this species averaging from three to four pounds in weight, 746 large-mouth black bass of the same size were rescued.

The fish taken from Lake Chabot were transferred to iced tanks in retaining ponds near the city of Sacramento where they will be held until they are introduced into other waters.

The Sacramento perch has long been considered practically extinct in California waters. The nature of the spawning habits are such that it can not exist in water occupied by catfish or carp. The female fish deposits its eggs in long bead-like strands upon the branches of submerged vegetation. Other spiny-rayed species build nests in the sand and before the eggs are hatched, both parents fight off intruders from the nest. The suspended egg of the Sacramento perch makes it an easy prey for rough fish in the streams.

The 2000 adult Sacramento perch are to be introduced into two clear, cold freshwater lakes in Sacramento County especially provided for the purpose. These lakes contain no other fish life and an abundance of fish food. It is hoped that with this breeding stock, propagation methods can be carried on which will result in the rehabilitation of this species throughout the waters of this state.

The gamy habits of this species and the white, flaky meat make it a highly desirable inhabitant of the waters of the Sacramento and San Joaquin valleys where it was once abundant.—Leo K. Wilson, 510 Russ Building, San Francisco, California.

FREAK FISH COMMON

One doesn't always have to go to a circus to see the freaks of nature. Several double-headed trout were recently hatched at the Yuba river hatchery of the Division.

To the general public this probably is something, but, according to J. H. Vogt, assistant to the chief of the Bureau of Fish Culture, it is just another common occurrence. As a matter of fact many types of freak fish are apt to appear in large hatchings of fish eggs; this is especially true in California where the State raises from thirty to forty million trout in a season.

In hatching methods, Vogt said, the eggs are placed in screen baskets and suspended in troughs of running water. The hatchery must be located on a stream where the water is well aerated and of an even temperature.

Attendants constantly watch the eggs as they develop and make sure that the infertile ones are removed, he said, and after about 40 or 60 days, depending on the temperature of the water and varieties of trout, the young fish appear.

These young fry live on a yolk sac attached to the underside of the body. It generally takes several weeks for the fish to absorb this sac. When they start to swim against the current it is time to start feeding them prepared liver and milk.

Vogt said that the freaks generally appear during the yolk period. They seldom live beyond the first stages of growth and are removed from the troughs during the cleaning up process.

TROUT SPAWN MANY EGGS

How many eggs will a trout spawn during its life cycle?

This question has been a perpetual source of argument among anglers and it probably will always be a topic of campfire discussion.

To begin with trout regeneration is regulated by many complex factors, according to W. H. Shebley, chief of the Bureau of Fish Cul-

ture of the Division. He has spent many years in fish culture work and has made a deep study of the subject.

Among the factors regulating the spawning activities of trout are the species of fish in question, climatic conditions, stream temperatures, food supplies, stream conditions, seasonal variations, health conditions and many other reasons, the fish culturist said.

In speaking of any particular variety the hearty rainbow trout can be taken for an example. This species is very sturdy and also very popular among sportsmen.

Under ordinary conditions the rainbow trout will mature in from three to four years. Its life cycle is generally completed in about ten years, according to Shebley.

The first spawning, say at four years of age, will bring forth about 600 eggs. As the trout grows larger and more mature the number of eggs spawned will increase until a limit of about 2000 eggs is reached in a season, the culturist said.

"Of course, you must understand that these figures are just estimates based on the assumption that all conditions are ordinary and normal," Shebley said.

It is figured that the rainbow trout has a spawning life of about six years and that she will deliver about 10,000 eggs in that time, he said. Some fish may grow to an older age and produce more eggs and some fish may die earlier. It is an extremely complex problem, and one that is constantly being studied at the various State hatcheries.

FISH HUBBY GOOD NURSE, BUT BABES SOON GO BYE-BYE

At least one species of fish wife has a "nest" in which to lay her eggs—thanks to perhaps the most thoroughly domesticated hubby on record.

At around this time of the year the black bass husband sets to work building a nest for his prospective family of from 2000 to 10,000 youngsters, according to a bulletin of the American Game Association.

He prepares the nest by fanning away from the spot selected all unwanted material. Larger obstructions he removes with his mouth.

After the eggs are deposited the male stands guard over them, never leaving for a moment and constantly fanning the nest to keep it free of sediment, until the tiny fish appear sometimes many days later. During this period he is so ferocious he will attack any kind of intruder.

When his multitudinous offspring are only a few days old, however, they swim beyond his parental control and enter upon a wayward life which soon makes most of his watchfulness go for naught as far as anglers are concerned. The little fish which grow faster than the rest promptly begin devouring their brothers and sisters, and very few bass reach maturity.

Guarding bass are easily caught, and when taken from the nests the eggs for which they died are invariably destroyed by fish, terrapins and other enemies.

Fish experts so far have been unable to devise a method for propagating black bass artificially in fish hatcheries, where other popular game fish are reared by the millions to restock depleted waters. For this reason nearly all states where bass are found are now carefully promoting natural replenishment with closed fishing seasons and spawning refuges.

TROUT LIVES 19 YEARS

How long will a trout live?

Perhaps this is not a very fair question because of the numerous varieties of trout, diversity of conditions in localities, endurance qualities of the species, changes through evolution and a host of other vital, technical reasons.

Therefore, to amend the question—What is the age record in California for any species of trout under any conditions?

W. H. Shebley, noted culturist in charge of the Bureau of Fish Culture of the Division, declares that he raised a Dolly Varden trout at the Shasta trout hatchery and caused it to live for 19 years. His records prove his authority.

According to Shebley the fish was hatched in the year 1898. He was in charge of the hatchery—it is the largest trout hatchery in the



Fig. 126. A Dolly Varden trout lived to be nineteen years of age at this, the Shasta hatchery. This is the largest trout hatchery in the world and one of the finest. The photo shows the rearing ponds and Mt. Shasta in the background. Photo by E. S. Cheney, July, 1928.

world—at that time and started the experiment which was to end in the year 1918 when word was sent to him at Sacramento that the veteran Dolly Varden was dead from natural causes.

The fish weighed between thirteen and fourteen pounds at the time of death and showed various outward signs of old age, according to the culturist. He said that it was the oldest trout of its kind upon which he had any record.

Shebley also revealed that this trout produced between 20,000 and 30,000 eggs during its lifetime. When it is considered that a great majority of these eggs hatched and produced fish, this one Dolly Varden was a very valuable asset to the natural resources of the State, he said.

FISHING AS AN ESCAPE

Fishing offers rather the same escape from the troubles that infest the day as does the reading of a detective story. In both cases the occu-

pation is a focusing of the attention on something quite apart from the self. The angler is intent on his line, the reader is intent on his crime.

Probably the brain worker turns to fishing for several reasons. He may simply like to fish; or he may need air and sun without too much exertion, since brain workers are proverbially underexercised; or he may find in it distraction from thinking.

Personally, the thinking I do while fishing is purely and solely about fish. Are they here? Shall I move there? To me fishing is a philosophy rather than a sport. I hold no brief for competitive fishing; the biggest fish, the most fish, mean nothing to me. I know no envy, and I know only one resentment—the useless killing of brave big fish which are merely trophies.

In pursuance of my philosophy, it is almost enough simply to be fishing. Almost, not quite. I want a fish now and then. Not any furious desire for fish defeats my purpose, which is primarily a sense of peace. I do not think about peace, I merely feel it. I think about my line, deep in the sea, or the fly, badly cast to a pool in some mountain brook.

And the surface of the water becomes mysterious to me, covering the things I can not see. If I think at all, it is about those things I can not see.

One day at the ranch I went fishing up the canyon. I sat all afternoon and caught no fish. When twilight fell I was still there, out on a rock in the roaring stream; and a cowboy on horseback on the trail above, unable to make me hear, had to shy a stone into the water to attract my attention.

"Hey!" he shouted. "Don't you want any supper?"—Mary Roberts Rinehart.

BOYS' CLUB HELPS SAVE FISH

Here is an interesting bit of fish conservation news that was submitted for this issue by a San Francisco sportsman.

Recently, at a Campfire of the San Francisco Boys' Club, on the Noyo River, President C. W. Marwedel recited to the boys the radio talk of one of the members of the Fish and Game Commission, in which it was related that in a test of some ten water snakes caught in an afternoon in one of our streams, nine were found to contain young fish, in a number of instances as many as 30 to 35. He called attention to the beautiful stream on which their camp is located, and the pleasure many of the boys had derived in catching trout. "Boys," he said, "let's get in and save the young fish in our stream. I will give a bonus for catching the water snakes, and if you will bring them to my tent at the siesta hour, at noon, and again in the hour after dinner, I will pay five cents for each large water snake, and the same for two medium and three small."

For the next two days, President Marwedel was busy paying for snakes, and in all one hundred and ninety-seven were caught and \$4.50 paid out to the snake hunters.

President Marwedel promises to continue the hunt and rewards each year in the week in which he is in camp.

FEELING WARM? THEN PITY THE LITTLE FISHES

If you could change yourself into a fish, you still wouldn't be able to escape the heat. Finned fanners of liquid depths have their heat

wave worries, too—in fact, more than city dwellers, and largely because of them.

Not only are fishes extremely sensitive to temperature variations, and devoid of all comforting “fans” except an occasional outboard motor propellor—whenever people start saying they are “just about to suffocate,” fishes by the thousands are actually suffocating.

Thus blasting a popular summer-time fancy, officials of the American Game Association have announced that high temperatures combined with unusually low water levels are already taking a huge toll of valuable fish life. Bodies of water whose contributing streams have dried up, due to a continuation of drought conditions, are losing their supply of oxygen.

Rescue squads are already at work in California, Montana, Wisconsin, Missouri and other states. More than a million fishes were saved in each of these states last summer, the first season of extreme oxygen “depression.” Outboard motor boats were used on several lakes as an emergency relief, to disturb the water so that it would absorb more oxygen from the air.

The Wisconsin game and fish commission has found that fish are dying in greatest numbers from the heat in waters which are most heavily polluted with the untreated sewage poured into them by cities, towns and villages, the officials reported.

Although an estimated 85 per cent of all the waters in the country are sufficiently polluted to be dangerous to fish and human life the year round, they said, hot weather aggravates the condition. Heat hurries decomposition, increases the poisons in the water and causes the loss of a greater amount of oxygen.

RECKLESS MOTORBOATING HIT BY NEW STATE LAWS

With outboard motors apparently turning every known variety of aquatic craft larger than a waterbug into speed boats, three states have recently passed laws to check reckless driving on their waters, says a bulletin of the American Game Association. New laws in Michigan and Pennsylvania authorize officials to silence, slow down and otherwise regulate motorboats as being unnecessarily dangerous to bathers, obnoxious to waterside residents and destructive to valuable aquatic life and fish spawning beds. The Indiana legislature forbade the operation of any motor craft on lakes smaller than 325 acres between April 1 and June 15—when fish are spawning—and restricted the speed to ten miles an hour at other times.

HOW TO PRESERVE TROUT

Many pounds of fine trout are wasted every year because anglers do not know how to preserve the catch. By proper handling it is possible to keep the fish in excellent condition while traveling far distant from mountain streams. Following are a few suggestions as offered by the Division on the art of preserving fish.

Clean fish as soon as possible, wash and hang up to dry out. Do not put any more water on them. Hang outside at night. To keep trout several days before taking home, lay out over night to drain, then pack good in willow boughs or sod grass, a layer of fish and a layer of grass. Roll them up during the day in a damp gunny sack and lay out each night to air and cool.

Another method suggested is to wrap each fish in silk paper after cleaning and drying, then roll in a dry sack or piece of burlap, and wrap again. The extreme outer sack may be wet, then carefully wrung out, and roped around the dry bundle. Keep in a cool place away from the air, inside if possible. Tie the bundle at the ends much the same as a tamale is tied. Do not open until the fish are to be used. Such bundles have been shipped in a box with ice for thousands of miles.

The theory of saving trout is to keep them cool, clean, dry and away from the air.

If fish are to be shipped in ice, this method is suggested: Put a lot of green grass blades or similar material in the bottom of the container, and after wrapping each fish separately in more green material and all are packed in, put a batch of green material on top. Put paper on top of fish letting paper down over sides of box. Then put in ice broken in small fragments to the depth of from four to six inches, fold paper back over ice, put more paper on top, nail on cover, and mark box, "Perishable, This Side Up." The paper will exclude the air and the ice melting very slowly will trickle down through the packed fish.

COMMERCIAL FISHERY NOTES

NEW SALMON LAWS

Many inquiries are coming to the Division relative to the salmon laws. Here is a short review of the amendment to the salmon law, approved by the State Legislature and signed by Governor James Rolph, Jr.

The principal changes are in Section 634 and include: a size limit of 27 inches on chinook salmon, and 24 inches on silver salmon that may be taken, killed or held in possession in districts 6, 7, 8, 9, 10, 11, 15, 16, 17 and 18.

A new provision requires that all salmon under legal size caught, accidentally or otherwise, must be landed by means of a landing net or scoop net and returned to the water unharmed. It is unlawful to operate any salmon trolling boat not equipped with landing nets or scoop net, or to gaff, club or injure any salmon under legal size.

It is also provided that in districts 6, 7, 8 and 9 the open season shall be between May 1 and September 15, and no salmon may be brought from the high seas through these districts between September 16 and April 30.

In districts 10 and 11, the open season is from May 1 to August 15, and no salmon may be brought through these districts between August 16 and April 30.

In districts 15, 16, 17 and 18 the open season is from April 1 to June 30, and no salmon may be brought through these districts between July 1 and March 31.

A new commercial district has been created by taking the upper portions of the Sacramento and San Joaquin rivers out of district 12b and creating district 12c. In district 12c the salmon season will be closed from June 16 until November 14, both dates inclusive.

STATE RIGHTS UPHELD BY COURT

The United States Supreme Court dismissed the appeal of Charles F. Noack and others vs. the Fish and Game Commission, which case went up from a decision of the District Court of the United States.

The original suit filed by Noack was dismissed by Judge Kerrigan on the ground that a court of equity would not interfere with the enforcement of criminal statutes. The fishermen then amended their petition, averring that section 634 of the Penal Code was unconstitutional on the ground that it was repugnant to the commerce clause of the Federal Constitution; that it denied them equal privileges and due process of law, and that the statute assumed admiralty jurisdiction.

The decision of the United States Supreme Court, in dismissing this appeal, upholds the right of the State to prohibit by proper legislation the importation of salmon caught on the high seas over or across any fish and game district when such district is closed.

THE EFFECT OF HADDOCK FLESH AND SKIN ON GASTRIC JUICE *

It has become popular knowledge that fish are more easily digested than beef or other meats. The reason has been found to be that some part of the fish induces a more active secretion of gastric juices. The present experiment shows that the skin of the fish is the most important agent, causing the flow of juices to increase from $\frac{1}{3}$ to $\frac{1}{2}$ more than fish flesh. The juices resulting from the stimulation of the agent in the skin is more acid than that caused by the flesh.

"These experiments are also of value for dietetics, for in all cases where it is necessary to cause a greater gastric secretion (as in convalescents, and in functional depression of gastric activity) fish with the skin on or broth from fish with the skin (small fish may be used for this purpose) may be recommended. In cases of excessive secretion of gastric juice (hypersecretion), or of gastric or duodenal ulcers, the flow of acid gastric juice on the food must be diminished, the taking of fish skin or bouillon from it must be avoided, but the haddock flesh without skin is then quite suitable food."—Paul Bonnot, July, 1931.

BASKING SHARKS ON THE PACIFIC COAST

The staff of this station were interested in Mr. E. W. Gudger's account of the capture of a basking shark, *Cetorhinus maximus*, taken on the New Jersey coast near Long Branch, an account of which appeared in *Science* of October 3, 1930. We were interested not because of the strangeness of such a catch, but because so much space was given to an animal which is so common with us that we may see one almost any day during December and January.

Twenty-one of these sharks were sold to the Monterey Fish By-Products Plant, of Seaside, Monterey County, California, between the dates of November 22, 1930, and February 13, 1931, the average weight being 2523 pounds. The largest was 6580 pounds and 28 feet long, the smallest 900 pounds and 15 feet long. The largest shark sold to the above firm at any time was a few inches under thirty feet and weighed 8600 pounds. The liver of this shark weighed 1800 pounds, 60 per cent of which was oil.

* Progress Report No. 2, Atlantic Biol. Sta. and Fish. Exp. Sta. Biol. Bd. of Canada. April, 1931. Note No. 5. B. P. Babbitt.

Because this fish feed directly upon plankton, the oil is clear, odorless and tasteless when carefully prepared and, in the writer's home, has been substituted for commercial cod-liver oil purchased at drug stores.

Little is known regarding the migrations of this shark on the Pacific Coast; in fact, little is known about it at all. It is a cold water form (which would be obvious because of its use of plankton for food), but it has been seen in numbers at different times of the year as far south as San Simeon Bay, California, and there are records of its having been taken at both San Pedro and San Diego. A 2000-pound specimen was taken here at Monterey Bay, May 19, last year; and another, 26 feet long, 6200 pounds, September, 1928; so apparently they occur all the year, but are most plentiful during December and January.

The reasons more of these sharks are not taken are that the price paid fishermen is only \$2.50 per ton, and the animals are so difficult to handle that fishing crews do not feel justified in equipping their boats for taking them.

They are now used entirely for fertilizer or chicken feed, the liver oil being used in the preparation of the latter. No doubt *Cetorhinus* will be taken in increasing numbers when the real value of the oil is appreciated as a substitute for cod-liver oil.

Two parasite copepods, *Anthosoma crassum* and *Denemature producta*, were taken from the 6200-pound specimen.—G. E. MacGinitie, Hopkins Marine Station, Science Vol. 73, No. 1897, May 8, 1931, page 496.

THE 1931 TUNA CATCH

Yellowfin tuna and skipjack fishermen have not had a successful fishing period since the voluntary cessation of fishing during December, 1930, and January, 1931. The demand for the tunas did not revive, and as a result of an agreement between the cannery and fishermen, another recess of fishing operations was declared for each tuna boat for 60 days (during approximately May and June). Even after this tie-up, very few boats went fishing until the middle of July or the first of August. The price was lowered to \$100 per ton for yellowfin tuna, and \$60 for skipjack, \$40 to be paid upon delivery and the remaining \$20 December 1, 1931, provided the price had not been lowered in the interim.

Early in June the cannery wanted to lower the price of bluefin tuna from \$110 per ton to a lower figure, their reason being that the price for the packed fish did not provide a profitable margin. After much discussion, which lasted until the latter part of June, the cannery and fishermen came to an agreement whereby the latter were to receive \$45 per ton upon delivery, and the remaining \$45 on or after September 15, 1931, if the price had remained constant during this period. The disagreement over the price, coupled with an apparent scarcity of fish has resulted in an exceedingly small bluefin tuna catch for 1931.—S. S. Whitehead, August, 1931.

PERMANENT QUARANTINE ON CLAMS AND MUSSELS

The State Board of Public Health, at its regular meeting held in San Francisco, April 11, 1931, established a permanent quarantine upon clams and mussels during the months of June, July, August and

September of each year. This quarantine covers the entire California coast from Monterey County to the Klamath River in Del Norte County, with the exception of the Bay of San Francisco.

Under the provisions of this quarantine order, the sale or offering for sale of clams and mussels gathered from the specified territory during the months of June, July, August and September of each year is prohibited.

FISH TAGGING EXPERIMENTS DEVELOP

The U. S. Bureau of Fisheries has tagged 1600 weakfish and smaller numbers of cod, scup, sea bass, and flounders at Wildwood, New Jersey, Woods Hole, Massachusetts, and elsewhere along the North Atlantic coast. The tag used consists of two celluloid disks attached near the tail of the fish by a silver wire. In addition to the disk tag, several fish have been tagged by putting a narrow celluloid strip, bearing a number, inside the belly cavity of the fish. Fishermen and others finding either of these types of tags are requested to send them to the Commissioner of Fisheries, Washington, D. C., together with information concerning date and locality of capture. A reward of \$1 will be paid for each tag returned with complete data concerning it.

All persons who are holding small metal strap tags attached to codfish are earnestly urged to send them either to the Commissioner of Fisheries or to Mr. W. C. Schroeder, Museum of Comparative Zoology, Cambridge, Massachusetts. The tags, either the disk or the strap type, will be returned on request to those who wish to keep them as souvenirs.

The cod tagging experiments during the late summer of 1930 in which disk tags were tried out in comparison with the metal strap tags have proved particularly interesting. Apparently, as a result of the use of the disk tag, an unusually large number of tags were reported within the period of January 20–February 24.

The returns to date from 171 cod marked with celluloid disk tags at Woods Hole, January 8-9, 1931, amount to four fish, taken between Block Island and Barnegat, New Jersey.

There are now 11 recaptures reported from 133 cod tagged on Nantucket Shoals in October, 1930, with disk tags, a few of them with belly tags. All these fish were taken between Block Island and southern New Jersey. This return of 8.3 per cent compares with previous returns of 0.5 to 1.31 per cent from about 25,000 cod marked on the Shoals from 1923–1929.

Although only 16 of the 133 cod had belly tags (in addition to disk tags) four of these have been reported recaptured; of these four, two of the belly tags apparently were overlooked, one was returned without mention of disk tag, and one was returned by the purchaser of the fish from which the disk tag was taken by the fisherman making the catch. Thus, two separate records were received for the same fish.

No returns have been received from 68 cod marked with metal tags on Nantucket Shoals the summer of 1930 and none from 169 fish marked with metal tags at Woods Hole, January 8–9, 1931.

The celluloid disk tag has produced decidedly better results thus far than the metal strap tag in two experiments where both types could be directly compared.—*Fishery Science and Trade*, Vol. 3, No. 3, March, 1931, p. 16.

CLAMS PLENTIFUL

Clamming at Moss Landing and the mouth of the Salinas River was reported to have been quite good during the early part of March. This is said to have been due to the rough surf which brought the shellfish in from the outer bar. There is understood to be a good supply of clams fairly well out at all times, but they can not be reached there by diggers.

FISH LANDINGS AT NORTH PACIFIC PORTS

Bureau of Fisheries (U. S.) Statistical Bulletin No. 915 shows that during January, 1931, 37,100 pounds of fishery products, valued at \$2,382 were landed by American fishing vessels at Seattle, Washington, compared with 206,500 pounds, valued at \$12,892 for the same month a year ago. This is a decrease of 82 per cent in amount and 82 per cent in value. The receipts of Seattle wholesale dealers by other than halibut fishing vessels, but not including products received from Alaska and Canada, amounted to 164,952 pounds, valued at \$10,269 as compared with 191,298 pounds, valued at \$12,571 for the same month a year ago. This is a decrease of 14 per cent in amount and 18 per cent in value.

No halibut were landed during January, due to the closed season in the halibut fishery.—*Fishery Science and Trade*, Vol. 3, No. 3, March, 1931, p. 19.

CAUGHT BIGGEST CLAM

A clam that weighed six and a quarter pounds was brought to town today by Jimmie Guthrie, well known fisherman and publicist of Harker's Island. The clam was caught at Cape Lookout along with several others of very large size.—Beaufort, N. C., *News*.

CRABS REAL HOME LOVERS

When you gaze at the hard exterior of a crab, shed a tear, for he may be homesick. Though they walk sideways, and slowly, crabs taken away from home will travel miles to get back. So declares a British government report on crabs, which has just been issued. Some crabs, taken from Spurn Head, in Yorkshire, and released along the Lincolnshire coast of England, at once started for home. Twelve of them were later caught near their birthplace, having traveled from 12 to 35 miles. Some went on to Filey, one actually crawling 75 miles measured in a straight line, and perhaps hundreds of miles as the crab walks.—*The Fish and Oyster Reporter*, May, 1931, p. 17.

CONSERVING WHALES IS WHALE OF A JOB

A few years more may make a whale of a difference—to whales, predicts A. Brazier Howell, executive secretary of the Council for the Conservation of Whales. Unless protected from destructive whaling practices these unique creatures—largest mammals on earth, inhabiting the water like fishes—will soon disappear from the United States' Alaskan waters and elsewhere, he has informed the American Game Association.

After failing to secure legislation in the last session of Congress regulating the taking of whales, the council launched its 1931 program with a hearing before the Senate's Special Committee on Wild-Life Resources. At this the council's technical committee described the condition of whales and whaling as "perilous."

UPLAND GAME BIRDS

HAIL TO THE KING!



Fig. 127. California quail is now the real authorized State bird. Here we see some other native birds doffing their Sunday silk-tops to the new king. Drawing submitted through courtesy of *San Francisco Chronicle*, April 6, 1931.

CALIFORNIA'S STATE BIRD

Choice of the valley quail as California's official representative is hard to criticize, even though many fine birds, both attractive and distinctively western, have been nominated for the accolade. The legislative committee has made an appreciative decision.

Aristocratic, distinguished, spirited, with beautiful manners and a pleasant voice, the valley quail is a fine cavalier in a State whose traditions run back to cavaliers. And who does not know him, this gallant figure that treads city parks as bravely as the desert paths? He is everywhere throughout the State except in the darkest forests and on the highest peaks—an essential element of the California scene.

Some of the others were hard to pass by—the colorful western blue jay, equally characteristic of the California hills, though, it must be confessed, deficient in manners and voice; the western kingbird, uncompromising foe of all robbers and oppressors, surely as spirited a bird as ever lived; the gay, melodious and ever-charming meadow lark, he who finds every season appropriate for optimistic song; the water ouzel, modest and retiring, but, when his acquaintance is made, a prince among birds.

These and many another could have worn the crown with credit, but surely none can deny the full merit of the valley quail—the living spirit of California.

INCREASE IN SUPPLY OF QUAIL

In the effort made during the past year to reestablish the supply of native quail by the establishment of quail sanctuaries and through natural channels from the nucleus of wild birds in the fields, it may now be recorded, with sincere thanks to the interest and activity displayed on the part of many of the volunteer deputies, coupled with the cooperation of the landowners, farmers and ranchmen, about 1000 inviolate quail sanctuaries and game refuges have been established within the State.

These sanctuaries contain upwards of 600,000 acres of land, upon which it is estimated there are about 300,000 wild valley and mountain quail.

Reports received from deputies during recent months indicate that in spite of this being a dry year, late and cold rains, and cloudbursts in some sections of the State, the quail have bred well, the broods of young birds are large, and that there is a noticeable increase in the supply of quail to be seen on the sanctuaries in every part of the State.

During the past six months the volunteer deputies have destroyed the following number of predatory birds and animals: 38 coyotes, 43 coons, 33 bobcats, 549 house cats, 89 skunks, 35 foxes, 8 weasels, 5 wild dogs, 2 opossums, 1 badger, 307 magpies, 3722 bluejays, 81 crows, 365 sharp-shinned and Cooper hawks, 49 butcher birds, 2 great horned owls and 47 snakes.

CATALINA CATS AND QUAIL

In a report received from Herbert M. Sangler, volunteer deputy, it is revealed that there are quite a number of quail on Catalina Island, but the birds do not seem to increase from year to year in large numbers.

“This is due to the fact, I believe, that there are so many stray and homeless cats which roam the island in search of food,” he said.

“Since January 1, this year, 110 cats have been trapped. Fish scrap is used for bait. The number of cats shot and killed is not known.”

He also reported that many cattle, goats and horses roam over the island and probably destroy many of the quail nests. The report also stated that dove are not plentiful on the island, due, in part, to the same reasons that effect the quail supply.

PHEASANT EGG RECORD

Excellent spring weather is aiding in the establishment of fine records at the State game farm at Yountville. During the week ending April 3, 2347 ringneck pheasant eggs were produced, and this is the greatest record in the history of the farm.

The first shipment of the season went forward to E. W. Smalley, captain of patrol at Hanford. It consisted of two cases totaling 576 eggs.

In referring to conditions, Farm Superintendent August Bade said: "Our incubating capacity is full at the present time, so that is the reason we are sending out these early eggs into districts that have early warm weather. By the time we have these districts supplied, it will be time to help other places where the season is later."

A delegate of the Sonoma County Sportsmen's Association visited the farm and made arrangements for the handling of about 1000 eggs. The clubman announced that the eggs would be hatched and brooded by the association and that the birds would be used for stocking purposes.

PHEASANT POPULATION GROWING

The pheasant population at the State Game Farm at Yountville, operated by the Division, has failed to hear any of the talk of depression, according to figures submitted in July by August Bade, superintendent.

During the laying season, the ring-necked pheasant hens on the game farm produced a total of 40,069 eggs, or an average of 66 eggs per hen during the period. This is 16 eggs per hen above the general average usually figured by game breeders as the season's production.

A large majority of these eggs were hatched in the incubators at the game farm and young birds are now ready for distribution to many sections of the state.

PHEASANTS RELEASED ON SCHOOL PROPERTY

The following interesting news was received from the Viking Print Shop of the Voorhis School for Boys at San Dimas:

"It is no uncommon sight now to see a brilliant cock pheasant proudly escorting three or four hens of his tribe about the school grounds, especially since the release on June 26th of 96 additional pheasants on the athletic field by the State Game farm.

The new birds are ringnecks. The largest part of them were hens about 16 months old which had been laying eggs for the incubators at the game farm at Chino. Some of them had laid as many as 80 eggs, it was said, but their laying period was ended, largely due to scarcity of suitable feed. The man who delivered the pheasants said that because of the change in feeding ground and the freer range here they would probably soon begin to lay again.

An interesting phase of the release of the birds was that almost without exception they flew vertically into the air as soon as the cage was opened, to a height of about thirty feet before starting off in horizontal flight."—H. H. C.

PHEASANTS DO NOT KILL BABY RABBITS

The cocky ringneck pheasant, blamed for many depredations, is absolved from the belief that he and she kill young rabbits, according to findings of officials of the Pennsylvania Board of Game Commissioners.

These officials observed hundreds of rabbits, varying in size from six inches to adult, in all the fields at the state game farms. On no occasion have the officials or any of the helpers seen pheasants molesting the young rabbits, some of which even entered the pheasant coops, a bulletin of the American Game Association announces.

BOOMING NOTE OF GROUSE

One of the most argued questions among old timers in the mountains of California is the method used by the cock grouse in calling to his mate. There is no more familiar sound in the yellow pine belt of the mountains of California, between 4000 feet and 7000 feet, than the booming note of the grouse, chiefly during the months of May and June.

Many and various are the statements made as to the way in which the mating cock grouse produces the booming call. Some old-timers are willing to swear that he stands on a hollow log and beats his wings in such a way as to make the noise. Others have stated that it is made by swelling out the membrane on his neck, thus increasing the volume of his crowing. Others have stated that it is made by the beating of the wings against his body.

There is one thing about which all old timers and naturalists agree, and that is that the sound is difficult to locate, and it is impossible to tell whether the bird is within a few yards or a mile or two away.

How rare it is to see one of the cock grouse performing his antics and producing his mating note may be judged by the fact that Assistant Superintendent Guy Hopping, of General Grant National Park, has lived in the mountains of the Sequoia and General Grant Parks for over 30 years and has only once seen a cock grouse performing his evolutions. Colonel John R. White, Superintendent of the Sequoia and General Grant National Parks, was 11 years in the mountains before he saw the cock grouse at its game. Colonel White recently returned from an inspection trip to General Grant Park, and it so happened that he left Ash Mountain headquarters in Sequoia National Park at 5 a.m.; and in the early morning, while on the Sand Creek Road between Pinehurst and Grant Park, he had an exceptional opportunity to see a cock grouse drumming. Colonel White first saw the bird a few feet ahead of his car and was astonished at the brilliant mating colors, thinking at first that it was a Chinese pheasant or some imported bird. The brilliant yellow membranes on the neck were especially prominent, as was the scarlet comb. The cock grouse had his tail up like a peacock and feathers all puffed out, so that he looked twice his usual size. Colonel White stopped and

watched the grouse strutting along the road within ten feet of the car. The bird then flew to the bough of a yellow pine below the road, so that the grouse was on the level with the car and less than fifty feet from it.

The grouse then began to walk up and down a small limb, strutting and preening himself. Soon began the mating call, which appeared to come from the mountain above the road, and might have been half a mile or more away. However, by watching the bird it was clear that a faint noise was audible every time he puffed himself out and swelled the neck membrane. This noise synchronized with the boom that was echoed back.

It is clear that the noise is made only with his throat, and that the swollen neck membranes act in a ventriloquial manner to carry the sound and echo it back from a near by mountain.

Assistant Superintendent Hopping made the same observation many years ago, so that two old timers foregathered at General Grant Park and settled a much mooted question of the natural history of the Sierra Nevada.

THE LAST HEATH HEN

The Division of Fisheries and Game in Massachusetts reported, during July, that the last heath hen—a male—lives near the farm of James Green, in West Tisbury. Green is doing all in his power to protect this "last" bird and after it dies a natural death he is going to ship the remains to some natural museum.

On its reappearance last spring the bird was captured in a net trap and both legs marked with numbered metal bands. The bands will serve to identify the last heath hen in case it falls prey to natural enemies—and will serve notice that the heath hen has joined five other American birds now extinct.

Like the extinct passenger pigeon, countless thousands of heath hens once occupied this section of the country. They were slaughtered in great numbers, almost to the vanishing point, before protection was provided. In February, 1925, there were twenty-nine specimens on Martha's Vineyard and bird lovers hoped reproduction might save the breed. Then some one discovered that the birds were all males. Four months later there were only eight survivors.

The late Edward Howe Forbush, noted ornithologist, and many others, spared no effort to save the species. Dr. Alfred O. Gross, of Bowdoin College, who is also interested in protecting the partridge, or ruffed grouse, said of the heath hen: "How long this bird will live no one can safely predict, its going is inevitable, but ornithologists, bird lovers and sportsmen the world over will have the satisfaction of knowing that all possible was done to save the species from extinction. The State Department has assured us that the bird will be allowed to live and when death comes, whether it is due to old age, disease or violence, we will at least know that the life of the last heath hen was not wilfully snuffed out by man."

But further than that, Dr. Gross sorrowfully admits, nothing can be done about it. Science has contemplated reproduction of animal species without the male, but is helpless and hopeless without the female.

Perhaps by the time this unwelcome record reaches the press the last heath hen will have joined the growing ranks of the exterminated species. Surely nothing can be done to perpetuate this unfortunate bird family but the sacrifice may create better cooperative efforts among residents of this continent to prevent the passing of other threatened members of our animal kingdom.

DOVE SURVEY

A survey is being conducted by the Bureau of Education and Research on the dove situation in the State. It is requested that all deputies forward to the bureau, as soon as possible, the names of dependable dove hunters in the various districts. Through this medium it is expected to gather some valuable information for conservation work.

TURKEYS DO WELL

Wild turkeys liberated on Redwood Creek, Humboldt County, last fall are thriving, according to word received from Captain William Lippincott of the Division.



Fig. 128. Wild turkeys are thriving in Humboldt County. Here is one lone bird that strayed far enough from cover to get "shot" by a camera. Photo by William Harp, May 12, 1931.

One hen was found with sixteen young birds, and two other hens were found, one with fourteen young ones and one with ten. Other hens were apparently setting, as they were alone.

Due to the interest shown by those who are familiar with the wild turkey, a number of these birds were imported to the State game farms at Chino, in southern California, and Yountville, in Napa County. The species selected is the Mexican bronze turkey.

August Bade, Superintendent of State Game Farms, said that surveys were made to ascertain if California had much natural territory well adapted to these birds. Some excellent turkey range was found, he said, and efforts are being made to stock these sections.

Captain Lippincott said that patrolling forces are watching the progress of the turkeys in this section very closely. Sportsmen and residents in the locality seem to be very much interested in the welfare of the birds, he said, and indications point to great success with the species.

There is no open season on turkeys in California as yet.

PLANT WINTER FEED TO ASSIST BIRDS

Now is the time to sow patches for winter feeding of wild birds, a bulletin of the American Game Association announces in outlining a few of the better feeds and where to plant them. Fishermen are particularly urged to carry along some of these seeds which can be planted by merely scuffing up the earth with the shoe, dropping the grains and pushing the loose earth back over them. All plantings should be made close to cover, else many of the species of wild birds will not venture into the open to get the food, so great is the hazard from their natural enemies in the air and on the ground, observations show.

Wherever possible stiff stalk seed bearing plantings should be made so that the seeds will be held through the late part of the winter when natural foods are at their greatest scarcity and in greatest need, the bulletin points out.

Among these are Kaffir corn, sorghum and ordinary field corn. Some rape seed should be planted, for the greens from this plant serve as "salad" for the birds, a necessary part of their diet. And this plant is most likely to remain green throughout the winter in nearly all climates.

Corn is thought to be the best food for wintering quail and other birds. Observations carried on throughout several winters in the deep snow country show that quail wintered well on it. Of 106 quail observed that had access to corn, 103 came through a winter, all in fine condition. Two of those lost were killed by predatory hawks; the fate of the other quail is unknown.

It was shown that quail living on corn were strong enough to escape many times from the attacks of predators, only the two luckless ones being taken out of 106, which is considered negligible.

Landowners and farmers are urged to leave patches of cover in fence corners and plant some of these foods in or near them, to help carry the wild birds over the winter.

A fellow who runs a sporting goods store down in Tennessee is GIVING a pound of game bird seed with each box of shotgun shells sold, according to current reports. He is said to be the FIRST man to establish the practice.

DON'T BURN OFF LAND

"The time is fast approaching when burning fields will be recognized as a crime to be controlled by some official agency," in the opinion of Seth Gordon, president of the American Game Association.

"To penalize a man for killing game out of season and then let his neighbor destroy ten times as much with one match, because of his erroneous belief that burning off his land will help his crops, is not at all equitable.

"The many forest fires started by this practice, and its wholesale destruction of game, especially of nesting ground birds in the spring, will not long be tolerated—now that the nation has been awakened to the waste of forest fires and the plight of game."

CRIPPLED BIRD IS LURE TO GOLFERS TO PLAY NEW GAME

At this time of the year a golfer who walks into the rough to locate a golf ball that has strayed from the fairway may be startled by seeing a pair of crippled "snipe" flopping around on the ground. Don't take these poor cripples too seriously, advises the Izaak Walton League in a recent bulletin, because they are quite apt to be killdeers and their inability to fly is a fraud. In recent years these interesting birds have been increasing on golf courses which have one or more water hazards.

The sharp cries of the birds and their antics in displaying "broken" wings are merely invitations to play hide and go seek, because they have a nest or young nearby and they are doing their best to lure the golfer away from the family. Fluttering around with make-believe broken wings usually succeeds in doing this.

It is a good trick and the kind hearted golfer is supposed to play the game and make believe that he wants to catch the crippled killdeers. As soon as he is drawn far enough away from the nest or chicks the adult killdeers will fly away, their wings miraculously "cured."

WATERFOWL

THE DRY SEASON AND DUCKS

There is no doubt that the drought we are experiencing in practically all sections of the State this summer will be reflected in our duck shooting this fall. Not only are breeding grounds more limited in extent than ever before in California, but some areas may be entirely dry by fall.

Reports from the great duck and Canada goose breeding grounds in Modoc, Lassen, Shasta and Siskiyou counties indicate a water supply about one-third normal and many areas formerly marshy and suitable for duck breeding are entirely dry this season. This condition results in a concentration of the birds on sections now having water, with increased danger to the birds from disease and enemies a result of such concentration.

The Los Banos region of the San Joaquin Valley, always an important duck nesting area, is particularly hard put for water this summer. Most of the club grounds in this section, which ordinarily have water on them all summer to grow cattle feed, are now entirely dry, with little prospect of securing water until late fall. In fact, it seems probable that those clubs in this section that do not have their own wells will be without water this fall, until supplied by the winter rains. The result will be little or no shooting for them until well along in the season, less area for the birds to loaf and feed on and concentration of birds on the few clubs supplied with well water. Fortunately our duck refuge near Los Banos is at present well supplied with

water, due to Superintendent Asa McClellan's foresight in conserving his supply, and a large number of ducks are breeding on the property.

The Sacramento Valley will doubtless have water after it is turned off the rice in September. There will be abundant feed for ducks and geese in this valley next fall, with one of the largest plantings of rice ever made in the valley producing a vast feeding area in its stubble and much unharvested barley land available as well. The new duck refuge near Pennington will be operating next season and should assist this section materially in holding the birds in the country.

NEW REFUGE

The Division has just completed the purchase of the Gray Lodge Club, an area consisting of 2541 acres in the lower end of Butte County, for a waterfowl refuge. There has been an annual kill of in excess of 12,000 ducks on this property. This shows that it is an excellent duck locality. The Commission made an excellent buy as the owners have invested more than \$100,000 above the purchase price. The work that they have done on this ground is of benefit to the Commission in the use of the land as a refuge. This area will be fenced and operated in accordance with the plans that have been used at the Los Banos refuge.

The Los Banos refuge has proven its worth in many ways. There are hundreds of ducks breeding in that locality at the present time.

A PRICE OF PROGRESS

Joseph Mailliard, Curator Emeritus of the Department of Ornithology and Mammalogy, California Academy of Sciences, recently discussed before the Scientific Research Section of the Commonwealth Club the phenomena of diminishing waterfowl on our western coast.

"No one knows the actual decline in numbers of the shorebirds during the past fifty years," says Mr. Mailliard, "but it is certainly dangerously near 100 per cent. Market hunting alone, destructive as it was, could not have caused so marked a dwindling."

Despite the many reports from gun club enthusiasts there seems to be no question but that ducks are rapidly diminishing. Even on Lake Merritt at Oakland, where for years waterfowl have been free from molestation, the winter population is something like half what it was at one time.

The Curator Emeritus inclines to the opinion that such reduction in numbers is inevitable and results, at least in part, from the extensive reclamation of marshlands and the natural silting up of our estuaries, which, in turn, results from agricultural development.

This is a matter of interest to all upper bay communities which count among their most valuable assets the exceptional opportunities afforded for hunting and fishing. It would be little short of a calamity if, like large sections of the east coast, we must eventually sacrifice sport for progress, but it may be one of the prices of progress exacted by Mother Nature is just that.—*Vallejo, Chronicle*.

SPRIG NEST ON REFUGE

Sprig nested in quite large numbers during the past season on the Gray Lodge migratory waterfowl refuge of the Division, according to Asa McClellan, superintendent in charge of development work.

Pairs of mallard have also been noted but sprig seem to be the predominating species, the superintendent said. Conditions are ideal for them.

"Of course, I have not made any sort of a detailed survey of the bird population," McClellan said, "but when I first went into the flooded section I was surprised to find such a large variety of waterfowl. It is very deceiving from a distance and a person is liable to think the marshes deserted, but once you start penetrating the water and tule lands you suddenly find yourself in the midst of all sorts of winged life."

The refuge which is located near Pennington in the Sacramento Valley was recently acquired by the Division of Fish and Game as a



Fig. 129. Sprig nested in large numbers on the Gray Lodge migratory waterfowl refuge in Butte County. Picture shows the type of nest constructed. Photo by H. C. Bryant.

part of a program for a chain of such lands throughout the State. By maintaining such a system of protected resting grounds it is hoped to hold a large majority of the ducks in the State during the migrations from the north.

Money for the purchase of such refuge lands comes directly from the hunting license fund. The legislative act requires that one-third of all moneys collected annually from the sales of hunting licenses for a period of five years be set aside for such purpose. The program started January 1, 1928.

Four baby sprig ducks were hatched at Duck Island in Lake Merritt during the early part of June. The lake is located in the heart

of the city of Oakland, Alameda County. This is the third brood of wild fowl ever to be hatched at this lake. The wild birds generally migrate before hatching season.

NEW REFUGE UNDER DEVELOPMENT

Development work on the Gray Lodge migratory waterfowl refuge of the Division was well under way during July, according to J. S. Hunter, in charge of the State Bureau of Game Refuges.

This refuge was recently acquired by the State after a careful survey by the Game Refuge and Public Shooting Grounds Advisory Committee. The committee consists of the Director of the California Academy of Sciences, Director of Hooper Foundation for Medical Research of the University of California and five other members appointed by the Fish and Game Commissioners.

The area consists of 2541 acres in the lower end of Butte County, near Pennington, and has a plentiful supply of water near at hand. According to Asa McClellan, field superintendent, there is already between 800 and 1000 acres under water, and this despite the unusually dry season.

During the survey by the committee it was learned that there has been an average annual kill of more than 12,000 ducks on this property during the open season. This, Hunter said, shows that it is an excellent duck locality.

Former owners of the property invested more than \$100,000 above the purchase price to the Division, records show. These acquired developments include buildings, freshwater tank, various canals, levee construction, miscellaneous machinery, fences, roads and numerous other assets. McClellan said improvements would greatly simplify and speed the developments as outlined by the Division.

First on the program of work will be the construction of roads to various sections of the property. This will not only afford better patrolling facilities throughout the year, especially during the duck hunting season, but will be an essential factor in constructing additional lakes and canals.

After the roads are built then the work of repairing fences and other construction work will proceed according to plans, the superintendent said.

DESCRIBE LOCAL BIRD REFUGES

How farmers, public officials, and others can attract and protect birds by establishing refuges for them is told in a new Farmers' Bulletin entitled "Local Bird Refuges" just issued by the U. S. Department of Agriculture. "Farmers, in particular," says the bulletin. "will be interested in the establishment and maintenance of effective bird refuges, because the welfare of crops and the commercial success of the farm are intimately related to the numbers and kinds of birds present and to their economic tendencies. Bird refuges on farms have been most successful when established and maintained cooperatively by the landowner and a state game commission, an Audubon society, a bird club, or a school."

Local bird refuges may also be created in wood lots, along roadsides and right of ways, in community parks and parkings and cemeteries and on picnic, fair, school, college, and reservoir grounds and golf courses. All these types of land which are adaptable as bird sanctuaries

are discussed in the bulletin. It gives suggestions for planting trees and shrubs to make the areas more attractive for the birds. A table shows the preference of birds for the various kinds of fleshy fruits recommended for planting. It also refers to other publications of the department dealing with roadside planting, farmstead beautification, and methods of attracting birds.

Copies of the new publication, Farmers' Bulletin 1644-F, may be obtained free, as long as the supply lasts, by writing to the Office of Information, U. S. Department of Agriculture, Washington, D. C.

REDUCED WATERFOWL KILL FORESEEN BY OFFICIALS

Severe limitation of the number of waterfowl to be killed the coming season may be necessary as a result of long continued drought in nesting areas of the United States and Canada, officials of the Bureau of Biological Survey, U. S. Department of Agriculture, indicated today, after considering reports of bureau representatives recently returned from expeditions to northern areas of the United States and in company with Canadian officials to the principal duck breeding areas in Canada. Although federal regulations governing the shooting of ducks and geese were recently amended to reduce the open season throughout the United States by two weeks this fall and winter, still further restriction of the annual kill may be necessary, the officials stated.

The Biological Survey investigators brought back discouraging reports of unprecedented drought, of lakes and ponds and marshes turned into dusty barrens with no sign of aquatic life. They reported the almost complete absence of water during the breeding period in the great prairie breeding grounds of southwestern Manitoba, southern Saskatchewan as far north as Saskatoon, and Alberta westward to the foothills of the Rocky Mountains and northward to the vicinity of Edmonton. A marked shortage of breeding ducks and young was noted in the great delta region of the Peace and Athabaska rivers. In tours of several thousand miles the investigators saw only a few dozen small broods of young ducks in an area that in normal years has produced many millions of mallards, pintails, redheads, canvasbacks, bluebills, and teals.

The shallow prairie sloughs and lakes of the region have disappeared following about 10 years of reduced rainfall and three seasons of persistent drought, Biological Survey officials explained, and a far-reaching inquiry sent out by the Canadian Government has failed so far to show that the ducks have found other more remote breeding areas. Not all the ducks and geese that come into the United States are bred in the region surveyed, it was said, but a very large proportion of the wild fowl that make up the great flights know that country as their birthplace, and the shortage of breeding birds and the loss of so many young will have a serious effect upon shooting conditions both in this country and in Canada.

The Canadian and United States governments under the migratory bird treaty, it was pointed out at the Biological Survey, are both concerned over the disastrous conditions that now threaten the wild fowl of the continent. The two governments are therefore endeavoring to avert shortages by devising methods for saving an adequate supply of breeders for next season. The severity of the limitations that may be

necessary will not be determined definitely, the Biological Survey officials say, until after further conferences between the authorities of Canada and of the United States and until more information is received from the nesting grounds. It is apparent, however, they say, that the drought, which has caused so much distress and economic loss to farmers and to industry generally, will also directly affect the sportsman. To avert the grave possibilities of a permanent disaster to the wild fowl, the gunners in all sections of both countries will probably be asked to reduce their duck shooting this winter to a minimum, so that enough nature birds will survive to breed and thus enable the flocks to replenish themselves with the return of water to the parched areas.

HERDING GEESE BY PLANE

The tenderfoot who was sent out to round up the lambs on a western sheep ranch, and at nightfall closed the corral on 50 panting jackrabbits, met his match recently in two native Oklahomans who set out in an airplane to ride herd on a flock of wild geese.

They succeeded, but too well. Circling about the river banks they forced together an enormous flock, and drove the birds southward along the river. Here "hunters" were waiting in blinds, and fired almost point-blank into the mass of birds.

The fun was taken out of this new form of slaughter, however, when the "herd riders" in the airplane learned that game wardens had witnessed the incident. Oklahoma, like many other states with progressive fish and game commissions, prohibits the hunting of birds from airplanes, and the two airplane pilots paid fines of \$131 each.

GEESE AND SWANS

Flocks of wild geese, estimated to contain nearly a million birds, are resting on prairie lakes in Western Canada on their way to their nesting grounds in the far north, according to the fish and game department of the Canadian National Railways. Old-timers state that the birds are more plentiful than at any time within their memory. An interesting and encouraging feature of the northern migration of wild birds is the presence this year of flocks of wild swans which, a few years ago, were considered almost extinct.

MAMMALS

Fig. 130. Deer often become entangled in fences and other obstructions. This doe was discovered by game wardens and released before fatal results occurred. Note the angle at which the hind leg is impaled. Photo submitted in July, 1931.



Fig. 131. Making the woods safe for the wild animals in Modoc County. This photo, taken along the Southern Pacific Company right of way near Boles, shows strips of tin hung loose along top wire of fence as a warning to the wild animals. No deer have been reported killed through collision with the fence in this district since the markers were installed. Photo submitted in June, 1931.

ELIMINATE FENCES TO SAVE DEER

Mule deer in the Modoc National Forest are to be protected from a railroad line by the elimination of right of way fences, according to reports from Westwood. The line is the Great Northern Company which runs through the country from Klamath Falls to Bieber. Not that the deer can not hurdle the fences with ease, but it has been discovered that the mammals become frightened or confused, crash into the fences and break their necks. Holders of cattle grazing permits presumably will be required to sign releases of all such claims, according to the report. Close observations are to be made on the problem and if stock losses are more expensive than fences the fences will eventually go up.

KILLS DEER WITH KNIFE

An interesting story appeared in the *Fresno Republican*, recently, which told about a man killing a buck with a knife. The narrative reads as follows:

A color-blind Los Angeles man killed a deer with a butcher knife at Pine Springs in Lockwood Valley.

Take a deep breath and hang on. Here comes the story, verified by Bakersfield hunters who were on the ground. The southern sportsman didn't even see the deer at first.

His wife spotted it lying in the brush and called her husband.

"There's a wounded buck lying over there," she said excitedly.

He came running up with a butcher knife and she pointed it out to him at close range.

"Might as well cut its throat and put it out of its misery," he said. "The hunter who shot it probably will be along in a minute."

But no hunter came along, because after the buck gave its final kicks, the hunting party camped at the springs looked it over and there wasn't a bullet wound on its body. It evidently had been dazed to the point of exhaustion by hunters.

MORE DEER, MORE TOURISTS, CLAIM HUNTING CRITICS

Two herds, threatening each other in a strange fashion, form the latest nightmare of trouble brought upon officials by the too prolific mule deer of the Kaibab National Forest, a high plateau on the north rim of the Great Canyon in Arizona.

The other herd in the extraordinary tangle, says a bulletin of the American Game Association, is the tourist herd—which has also increased at a great rate on the north rim of the canyon, largely because of the added attraction supplied by the Kaibab's deer.

The tourists, but especially Arizona citizens interested in this human herd, have raised a howl against efforts of government agencies to reduce the deer herd.

A growing faction is claiming that if the number of deer is decreased the north rim tourist trade will die out. The officials representing the United States Forest Service, the Biological Survey and the Arizona Game and Fish Commission, have contended that unless the deer herd of about 20,000 is cut down more strenuously and successfully than in the past it will soon completely destroy its food supply, already badly depleted, and disappear of starvation and disease.

To settle the controversy the officials called upon all the national conservation organizations. Leaders from the American Bison Society, the American Forestry Association, the American Game Association, the American National Livestock Association, the Izaak Walton League, the Camp Fire Club of America and the National Association of Audubon Societies were in the Kaibab late in June, studying the situation as an unofficial advisory committee.

Official investigators have reported that in spite of open hunting seasons and trapping and shipping, the only appreciable reduction of the herd has been from starvation and reduced numbers of young due to loss of vitality.

FAWNS APPEAR EARLY

Fawns appeared quite early this past year according to reports coming from various sections of the State. Here is an interesting note that came from observers in the Giant Forest, Sequoia National Park:

As has been the case for several years, the first fawn of the season was seen on June 14. Several have been seen since that date and more will be coming all the time. The little spotted fellows will soon be seen wobbling along after their mothers or curled up in a protected spot where their mothers left them.

Warnings are issued every year through the press and at camp fires that people seeing these fawns should never touch them. They are so cute that it is a great temptation to pet them but such an act may cost a fawn its life.

Fawns have no body odor for the first month of their lives. This is nature's way of protecting the young deer. They are so near the color of their surroundings that it is hard to see them, so the mother may leave them and go away for hours and the fawns will not move unless disturbed. Predatory animals may pass close by a sleeping fawn and not see it. The touch of a human's hand upon the little animal will leave the human scent, which will be noticeable to the wandering lions, bear, coyote or other enemy and the fawn would have no defense from an awful fate.

If a fawn is with its mother, it is sometimes possible to get close enough to take a picture of it, but if it is alone, do not try to get close to it. If a fawn is frightened away from its bed, it sometimes starts running and the mother has great difficulty in finding it again. It is pitiful to hear a lost fawn crying for its mother and the doe will be running around calling for her baby at the place where she left it.

The doe takes care of her fawn, or twins, until time for the new babies to come, when she quietly slips away from the yearling. It will go about looking for its mother for two or three days, crying like a kitten. Sometimes the doe will allow her yearling to go with her again after her new ones are a few days old, but not always. Deer have individual taste and habits, as people do. Some deer will be fond of one food which another will scorn. Some become very gentle, while others always retain a certain amount of timidity and will never learn to eat from a person's hand. Their characteristics are a never-ending source of amusement to those who are well acquainted with them.

SAVE THE FAWN

Fawns do not get lost! Whenever you find one of these little big-game animals wandering in the woods or near the highway you can rest assured that Mrs. Doe is near at hand and is well informed as to the location of her child. She may keep herself concealed, but she is there nevertheless.

Unfortunately Mrs. Doe does not always seem to be able to control the wanderings of her young. "Peck's Bad Boy" of ten follows



Fig. 132. Fawns do not get lost! No matter where you find them you can rest assured that Mrs. Doe is near at hand and does not approve of your attempts to "save her child." Note the spotted coloration for protective purposes. Photo by E. S. Cheney, June, 1931.

silly notions and does so without punishment—that is unless some uniformed member of the human species finds him "lost" and seeks to "save" him.

E. L. Macaulay, chief of the bureau of patrol, has issued an appeal requesting all persons to guard against the "fawn fever." It is an humane appeal.

"Drive carefully in the deer country so as not to destroy the wild animals," Macaulay said, "and when you find a fawn, or any other wild animal for that matter, do not try to take them for pets. In case you positively know that the mother of a fawn

has been killed or fatally injured be sure to note the location and report to the nearest State game warden. It is not very difficult to get information at habitations."

In addition to the harm caused by picking up these little fawns, a heavy penalty may be imposed upon those violating this section of the fish and game laws. A fine of not less than \$50 or more than \$500, or imprisonment for not less than 50 days or more than 150 days or by both such fine and imprisonment is provided for. Also, the official states, a permit from the State is absolutely necessary to keep these animals and due to the difficulties involved in providing for their welfare, it is extremely difficult to procure such legal sanction.

FEW CARIBOU IN UNITED STATES

The last herd of caribou known in the United States, consisting of an estimated 400 animals but very possibly considerably fewer, now roams Isle Royal in Lake Superior, and it is possible this last group

may cross over the ice some winter and disappear into Canada, according to an oral statement recently made by Vernon Bailey, senior biologist of the Biological Survey, Department of Agriculture.

Caribou until recent years were found in small numbers in Maine, the "panhandle" of Idaho, Isle Royal, and the region of Minnesota opposite Isle Royal. Hunting has pushed them northward until most recent reports show that there probably are not more than two or three, if any, caribou in the Idaho region, the last herd of 25 known in Minnesota has disappeared, and none are known in Maine.



Fig. 133. Deer occasionally misjudge their footing. This animal lost its life through accident on the R. R. Russ ranch in Lake County. Photograph submitted by R. A. Russ, July, 1931.

TRAGEDY

Deer are not always as sure footed as one would imagine. Accidents often happen to these big game animals and many times the results prove fatal.

The accompanying photograph best explains what happened to the deer found on the R. R. Russ ranch in Lake County on April 10. As

the picture shows, the animal had been dead for a considerable number of days before being found.

As a means for explanation it is believed that the deer was standing on its hind legs in an endeavor to browse on the leaves, moss or mistletoe on the lower limbs of the tree. In some unknown manner the animal's front foot must have slipped into the narrow crotch of the tree and became tightly impaled during the proceeding struggles.—R. A. Russ, Lake County, July, 1931.

BEARS FEED ALL AFTERNOON

Dinner time for the bears at Giant Forest's famous Bear Hill is being changed from the regular 3 o'clock lunch hour to an all afternoon banquet, beginning soon after noon each day.

It has been observed for the past several weeks that many of the bears come in with gaunt and hungry looks, several hours before 3 p.m., and restlessly investigate the remains of the preceding day's meals. They then roam around or sleep till feeding time. Little or no action or performance occurs until the meal is on the table.

Beginning July 4th, the garbage trucks will start placing the bears' dinner at the Bear Hill platform soon after noon, and at frequent intervals thereafter all afternoon. The bears may readily be seen and enjoyed at any time during the afternoon and evening. The best shows, with the largest numbers of actors and the most "teddy" bears, usually occur late in the afternoon.

Park visitors will much benefit by this change in feeding time. Hundreds, even thousands on week-ends, come to see the bear show, and the congestion of cars and people has detracted from the performance of the bears. By spreading out the time of feeding, more people can see the bear show and without the difficulty of getting a good seat and parking area.—*Sequoia National Park Service.*

BRUIN SHOCKED

Bears caught robbing the traps at the Yellowstone Fish Hatchery recently were "given the works," but not to a fatal degree.

It happened this way, according to Park Naturalist Alfred H. Povah. The traps, placed at the most advantageous spots in a number of creeks, were supposed to catch quantities of fish ready to spawn, and thus supply plenty of eggs for restocking purposes. Plenty of fish were seen in the creeks on their way to these spawning grounds, but the traps remained empty. The fish culturists, acting as piscatorial detectives, solved the mystery. Through a few scattered eggs lying along the bottom of the creek just below the trap, they deduced the fact that bears were robbing the traps, and decided to administer an unforgettable lesson.

These traps were inclosed in a fence of wire screening about three feet high. Inside this and about one inch away from it, the hatchery men strung a single strand of heavy copper wire. This was connected with two large storage batteries, hidden in a nearby box, in such a way that when the wire screening was pushed against the copper wire an electric contact was made. The fact that the bear depredator had to stand in water to reach the trap assured a "ground" for the electric current through the animal. This current, while not strong enough to injure the bears, gave them a positive deterrent against fish forays

Within a week after the shocking apparatus was installed the trap was full of fish—and there will be plenty of eggs for restocking the lakes and streams.—*Science News Letter*. July 4, 1931.

COYOTE DINES ON BOBCAT

Somewhere in the wilder reaches of Ventura County there must have been a meeting between a coyote and a bobcat. From all available evidence the coyote emerged victorious.

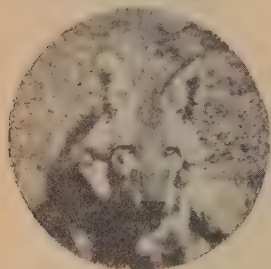


Fig. 134. Don Coyote is not very particular in regard to his diet. He will eat anything from bobcat to old shoes, and will thrive where others fail. This fellow appears to be very well fed. Photo submitted by C. O. Fisher, January, 1918.

And the evidence at hand has come to the office of the Division in the nature of stomach contents of the alleged victor. In making a study of the food habits of the coyote, game wardens are sending the stomachs of all victims to the office for examination.

Here are some of the facts that Donald D. McLean, field naturalist, learned about the fellow in question: The stomach was about one-quarter full and contained three claws, one toe, three toe pads and a quantity of hair, all from a bobcat. There was also a small quantity of grass and one feather shaft.

Whether the coyote inherited this banquet through the process of battle victory is, of course, a matter for speculation. Those who are acquainted with the defensive abilities of the wary bobcat are inclined to scout the battle theory, and declare that the cat must have been killed by some other agency.

However, it is anybody's guess and the fellow with an imagination for romance can feel secure in standing by the victor-spoils conclusion.

TELLS HOW TO TRAP BOBCATS

When bobcats become a menace to live stock, it is easy to catch them in common double-spring steel traps, sizes 2 and 3, says Stanley P. Young, of the Bureau of Biological Survey, in Leaflet 78-L, Hints on Bobcat Trapping, recently published by the U. S. Department of Agriculture. "Such traps," explains Mr. Young, "have been used by many generations of trappers, and although deemed inhumane by some persons, no better or more practical device has yet been invented to take their place."

Since human encroachment on the bobcat's natural haunts, where it is accustomed to prey on rabbits, other injurious rodents, and such valuable forms of wild life as antelope, deer, wild turkey, and quail, this predator has found the young of the domestic flocks and herds very satisfactory substitutes, says the leaflet. Where this new provender is more easily obtained than is food in the wild, the bobcat becomes a serious menace, the leaflet points out, as in Arkansas, where locally it has become a threat to the hog-raising industry. Urged on also by a lust for killing, the animal's depredations sometimes become exceedingly heavy; in one case, cited in the leaflet, a single bobcat killed 38 lambs in one night.

Field experiences of federal and cooperative trappers applying methods developed by the Bureau of Biological Survey, on which Mr.

Young bases his hints, have demonstrated that the bobcat can be caught in traps placed in holes dug directly in the trail of the animal and concealed with dirt. Fetid and natural scents and such lures as catnip oil, it is also explained, may be used to attract the animals to traps set on either side of the trail, near stubble, a bunch of weeds, an exposed root, or any object known as a scent post.

"Hints on Bobcat Trapping" furnishes further directions for making the various sets, preparing scents, and caring for traps. It also calls attention to the importance of such details as avoiding human scent near the sets, deodorizing traps, and caring for traps in frozen ground. This publication, Leaflet 78-L, may be obtained free on request to the Office of Information, U. S. Department of Agriculture, Washington, D. C.

BIG GAME ANIMALS PASS MILLION MARK IN THE NATIONAL FORESTS

"Big game animals in the National Forests now number more than a million head. A gain of approximately 9 per cent in 12 months is shown by the annual wild game 'census' of the Forest Service, U. S. Department of Agriculture, just announced, by the Department.

"The total big game population of 1,073,111 is an approximation of the number in the 151 National Forests as of the first of this year, the figures being based partly on actual count and partly on estimates by experienced local forest officers. Game animals on public and privately owned range outside the National Forests were not included in the estimates. The National Forests, however, include the greatest total area of big game range now remaining in Government ownership.

"This year's increase is chiefly in deer, but elk also have gained considerably. Moose, mountain sheep, mountain goats, and antelope, none of which are very numerous, show slight gains. Bears are keeping up the struggle for existence in fair numbers, although the great grizzly gave ground in many of the National Forests and black and brown bears suffered in some localities.

"Big game hunters, naturalists and the nature-loving public may thank better protection, systematic control of predatory animals, and better range conditions for the preservation and improved status of game, according to the Forest Service. Most of the increases have occurred on areas where only the remnants of larger herds were left a few years ago. The satisfactory results to date point to the necessity of careful estimates of range capacity and the development and application of management plans to prevent overstocking of certain areas, to provide restocking on others, and to secure an increase on still other areas, says the Forest Service. Increases in wild life thus far obtained have not resulted in a material curtailment of domestic live stock on National Forest ranges; through improved management the range is made more productive for both classes of animals.

"Moose in the National Forests were reported to number 7760, a gain of more than 2600, in part resulting from the inclusion in 1930 of the National Forests in Minnesota, where no count was made in 1929. There were gains for moose in Alaska, Montana, Wyoming, and Idaho. In Oregon National Forests, moose last year went the way of the grizzly in California. Not one was found. Four head of moose are

credited to the White Mountain National Forest in New Hampshire, where none were listed the year before.

"Hunters bagged 4352 elk in the National Forests last year, but there are 88,200 still running, as against 82,670 in 1929. Wyoming, Montana, Arizona and Utah account for most of the increase.

"One of the American game animals once supposed to have practically disappeared is the antelope. The National Forests this year, however, showed a 45 per cent gain in antelope as compared with 1927, the latest 'census' listing their number as 11,140, as against 7660 in 1927 and 10,220 in 1929. Arizona, California, South Dakota and Idaho lead. An attempt to establish a small herd of antelope on the Wichita National Forest in Oklahoma proved unsuccessful.

"Slight increases in bear population of National Forests in Alaska practically offset the losses in some of the States. There are estimated to be 2800 Alaska grizzlies and brown bears, and 5750 Alaska black bears. In several Rocky Mountain States few grizzlies remain—only one was recorded in Utah. The total National Forest grizzly population, exclusive of Alaska, is placed at 870. Deerlodge National Forest in Montana has 206.

"Black and brown bear are still found over wide areas from coast to coast. More than 50,000 of them live in the National Forests. Virginia, California, and Utah Forests show decreases in bears. Small gains are reported from North Carolina, New Hampshire, West Virginia, New Mexico, Arizona, and Alaska National Forests.

"First place for black and brown bears, Alaska excepted, goes to the Olympic National Forest in Washington, with 2080. Mount Baker National Forest, in Washington, is runner-up. Three or four other forests in the Northwest and in California, and the Superior in Minnesota have 1000 to 1500 each. About 800 bears are recorded for the White Mountain National Forest in New Hampshire, 350 for the Shenandoah in Virginia, and 100 to 300 each for several other forests in the East.

"Mountain sheep and mountain goats still range about the high peaks of Alaska and the northern Rocky Mountain States. This year's estimate placed the totals at 21,860 and 12,500, respectively. National Forests in Washington show an increase of 500 mountain goats, and a few mountain sheep have appeared there.

Colorado National Forests lead in mountain sheep, with 3500 reported. About one-tenth of all the mountain sheep and 10,000 mountain goats range in the National Forests of Alaska.

"The latest estimates showed deer on every one of the 151 National Forests. Under State and Federal protection and under hunting regulation in the National Forests, deer increased last year from 802,450 to 877,780.

"Despite the many thousands of deer bagged by the hunters, most of the National Forests in the West showed gains. California now has 259,300 deer in its nineteen National Forests; Arizona more than 91,000 with a gain of 6000; Colorado 36,380, with a gain of 3000. In the National Forests of the South deer showed increases; in most of those of the Middle Appalachians slight decreases. The Alabama National Forest, with 500 deer, showed a gain of 100 per cent. The Allegheny National Forest in Pennsylvania, with 5000 head, has 2000 more deer than the year preceding."—*DuPont Game Conservation News*, July 15, 1931.

LION HUNTING DANGEROUS SPORT

With more than a hundred wounds as proof, Gene Holder, a Biological Survey hunter in the Coconino National Forest of Arizona, is positive that it is not safe to stand directly under a mountain lion when intending to shoot one. Holder's dogs had treed the lion and, thinking to prevent it from falling over a cliff, he placed himself between the treed lion and the canyon. As he took aim his foot slipped in the snow and a wounded instead of a dead lion landed almost on him. After a desperate fight he killed it with his hunting knife, and then rode three days to Flagstaff to be treated by a physician.—*U. S. Forest Service Bulletin*.

CATS ARE FACTORS IN SPREAD OF RABIES

The State Board of Health, at its regular meeting held in San Francisco, April 11, 1931, directed that the attention of all health officers in California be called to the increased prevalence of rabies in animals and to the necessity for intensive action in the control of the disease.

The board directed, also, that the attention of all health officers be called to the necessity for the application of control measures to cats as well as dogs. It has been determined, recently, that stray, homeless cats are decided factors in the spread of the disease in this State.

POOR LITTLE SKUNK CRAVES HUMAN LOVE

Misunderstood! That is all that has been wrong with the poor little skunk, whose very name has grown to have odoriferous implications.

Experts now say the skunk is a charming companion and longs for nothing more intensely than to be with human beings, says a bulletin of the American Game Association. This accounts for its presence often noted, yet seldom appreciated, near farmhouses and even in villages.

The skunk is still listed as an undesirable in some states because of his alleged egg-eating and nest-destroying propensities.

MISCELLANEOUS

PROTECT HOMING PIGEON

A letter was received by the Division from W. E. Mabey, 1824 University Avenue, Berkeley, which states that homing racing pigeons are being shot and mutilated during training and racing, by hunters. The note said that "during the 1930 young bird series there were several birds that came home, flying distances ranging up to 500 miles, with their wings and breasts pierced with shot. Notwithstanding the fact that some of the birds cost about \$100, some action should be taken to end such cruel practices."

Many pigeon clubs begin the season's activities in May and deputies are urged to discourage the hunting of birds and to report violations to proper authorities.

BIRDS THE FLIERS

The ducks that wing their way northward through the March dawn, the hawks that hang and watch for a change to pick one of them off, even the robins and blackbirds that flit across the lawns, are still more efficient flying machines than the best of man's inventions. They have better designs, and they get more mileage out of a calorie of energy than any airplane now in existence or likely to be built.

This is brought out in a number of points in a study of bird flight which has been made by Dr. Lucine H. Warner, of White Plains. His findings will be published in detail in the forthcoming issue of *The Quarterly Review of Biology*.

Birds have so reduced the weight of other body-parts that they can devote from one-sixth to one-half their total weight to the flying muscles, notably the big ones that form the breast of the bird and pull the wings on the down-stroke. In the pigeon these muscles weigh as much as all other parts of the bird taken together.

The streamlining of birds' bodies has long been noticed. It shares this low-resistance shape with fishes and other swimming animals, but has the advantage of smoothing out hollows and irregularities with almost weightless feathers instead of heavy flesh. Many flying birds tuck up their feet, being prototypes of planes with retractile landing gear, and those that are too long-legged for this, trail their legs so as to make the least possible resistance in flight.

Highly efficient also is the utilization of food by birds, and its combustion in the tissues to produce energy. Analysis of food remains after digestion shows that birds assimilate much more of what they eat than do mammals. Their blood carries a higher number of red corpuscles per cubic millimeter, and therefore transports more oxygen to the final burning-places of dissolved foods, which makes for more efficient energy production.

Birds have a system of breathing peculiarly adapted to the needs of flying animals. The active part of respiration is exhalation, or breathing out. This is accomplished by compression of the ribs and breastbone, which surround the lungs. Thus the more rapidly the wings are moved, the greater the amount of air forced in and out of the lungs. A bird is thus less likely to get out of breath than is a mammal, which has a breathing apparatus quite independent of its movement muscles.

Dr. Warner also discusses the different methods of flight used by birds, and offers a new theory regarding the soaring flight of such birds as hawks and buzzards. It is his belief that such birds take advantage principally of the gustiness of the wind, adjusting themselves instantly to changes in its direction or force in such a way as to exploit its energy to gain additional lift.—*Science—Supplement*, Vol. 73, No. 1889, March 13, 1931.

CARBON MONOXIDE KILLS BIRDS

Here is a story, circulated by the *Associated Press*, that tells about the effect of automobile exhaust gasses on bird life, and the material herein may be of interest to ornithologists:

A never-ending gas attack from the exhausts of automobiles is taking heavy toll among English sparrows and pigeons, says Austin H. Clark, biologist of the United States National Museum.

These two birds, which formerly were common in the cities of Eastern United States, have been disappearing rapidly.

They feed largely on street refuse, which brings them into contact with carbon monoxide gas from motor exhausts. It is a heavy gas that tends to cling to the ground when there is no wind.

It takes very little carbon monoxide to kill a bird or weaken it so it is easily caught by cats, hawks or other enemies, Clark explains.

This is because birds live "at high speed." Their bodies transform oxygen into heat much more rapidly than human bodies.

They must have plenty of oxygen at all times. Anything such as gas that tends to block the oxygen supply from their lungs has a bad effect almost at once.

English sparrows were imported from Europe before the days of modern sprays and insecticides, to eat the canker worms that were infesting American elm trees.

They accomplished their purpose but aroused complaints among bird lovers because they drove away other birds from birdhouses and feeding places.

DATA ON BIRD PEST DRIVES

Approximately 150 of the many hawks and owls killed in the Cole County Anti-Hawk Club's (Missouri) last campaign came into the hands of Ernst Schwarz, state taxidermist for the Missouri Game and Fish Department, who examined the stomach contents of each bird. A summary of the species examined is as follows:

Red Tailed Hawk—fifty per cent of the total number of hawks examined were of this species, considered by the U. S. Department of Agriculture as highly beneficial to agriculture. Every stomach contained mice and other rodents. Only two stomachs showed even a trace of feathers. If the hawk was to feed on game he would have done it at the time the campaign was on as the winter was severe enough to cause a natural food shortage.

Barn Owls—the stomachs of the two specimens of this beneficial owl contained only rodents.

Barred Owls—several stomachs examined showed moles and rodents.

Broadwing Hawks—the eight stomachs examined showed only snakes and rodents.

Marsh Hawks—the five specimens showed only rodents, lizards and snakes.

Osprey—this "fishhawk" contained only fish.

Red Shouldered Hawk—the one specimen contained only rodents.

Screech Owls—the four stomachs showed only mice.

Short Eared Owl—the two specimens showed only mice.

Sparrow Hawks—the six stomachs showed only small shrews.

Cooper Hawks and Sharp Shinned Hawks—fewer than a total of fifteen of these hawks, less than 10 per cent of the total number killed, were taken. These stomachs showed feathers of several species of birds.

Great Horned Owl—the fifteen specimens taken revealed birds largely. A rabbit was found in one stomach.

Hawks and owls known by ornithologists to be found in this region but not taken in the last campaign included the snowy owl, American rough legged hawk, black vulture, turkey vulture, goshawk, golden eagle, long eared owl, saw whet owl, duck hawk and pigeon hawk.

It is pointed out that farmers are permitted to control any bird which causes them loss of their property and should landowners have an actual grievance they can take their own steps toward control of such creatures. It is possible that individual hawks of a nonharmful group may kill poultry and other birds but this practice is not the usual habit for most species.

NOTE—As a rule here in California we do not have the barred owls, broadwing hawks or the black vulture, and our species of red bellied hawk is a descendant of the red shouldered hawk. The snowy owl is also exceedingly rare in our State. We are also examining the stomachs of all species as they are secured by the Division.

BIRDS PREY ON RODENTS

Promotion of deadly air raids by nature's "fighting planes" is being urged by agricultural colleges as an urgent necessity in combating a threatened large increase in the number of field rats, mice and other rodents and the possible destruction of hundreds of thousands of dollars worth of crops.

Due to the drought and the mild winter an unusual number of rodents can be expected in most sections of the country, according to a bulletin of the American Game Association.

Rudolph Bennitt of the Department of Zoology of the University of Missouri has advised the Missouri Department of Fish and Game to encourage protection of beneficial hawks and owls, among the most effective enemies of rodents.

Though there are more than 30 species of hawks and owls in the state, Bennitt said, and only four that prey on poultry, game and other birds, many farmers kill them indiscriminately and indirectly cause heavy loss of crops, insect-eating birds and game from destructive small animals.

Sportsmen and farmers, before shooting hawks and owls, should apply to their state game departments for detailed information on which species are harmful and their description, the association report advised. This was declared important, since certain species considered undesirable in one section have been declared valuable in another.

The only hawks generally recognized by game officials as enemies of bird life are the Cooper's or "blue hawk," the sharp shinned hawk, the goshawk and the scarce duck hawk and prairie falcon, the report stated. The outlawed owl is the great horned owl.

GORDON ADDRESSES LEAGUE CONVENTION

Here is an excerpt from an address delivered by Seth Gordon, president of the American Game Association, to the Annual Convention of the Izaak Walton League which was held in Chicago during the latter part of April. A letter accompanying the material said, in part,

"we did our best to give the highlights of the outstanding developments during the year as they were known to us."

The address, entitled "Developments in Game Conservation" is as follows: "It is utterly impossible to present the important game conservation developments of the past year in a short address, but others on the program will cover in detail some of the items which for the sake of brevity must merely be mentioned in this paper.

"The term 'game' as herein used covers all birds, mammals and fishes which are usually pursued for sport or recreation. I am glad to say this broad definition is coming into general usage, and more of the states will no doubt shorten the names of their administrative departments in charge of game and other conservation affairs. And what a lot of time we will all save when those titles get boiled down to two words—either 'Game Department' or 'Conservation Department.'

STATE DEVELOPMENT IN BRIEF

"A study of the important developments in the states during the year is very interesting. The trend is most encouraging, but there is still entirely too much turnover in administrative personnel and shifting in policy. Personnel turnovers produce chaotic conditions because the tendency is not to build upon the foundation laid by a predecessor but to tear down and build anew. And that invariably is disastrous.

"The states which have made the most outstanding progress are those which have followed a constructive program consistently over a long term of years, regardless of changes in personnel.

"One of the most encouraging trends among the states is the tendency to vest departments in charge of game with broad regulatory powers to fix seasons and bag limits; to set aside refuges and public hunting and fishing grounds; to put field forces on a merit system; and to pay greater attention to scientific research. Last but not least by any means, the sportsmen are beginning to realize that they must contribute more money with which to do the many things they expect of their state departments."

The address then reviews in brief a few of the important developments in the various states, and for California, Gordon said: "The setting aside of 750 quail refuges aggregating about 500,000 acres was a big stroke. In many cases lands heretofore closed to hunting are now open, because the lands which the owners really wanted to protect are now included within the refuges. Refuges on water reservoir lands which were previously closed to all shooting also have portions of those vast areas available to the sportsmen."

Under the heading "Big National Developments" Gordon said: "The American Game Policy adopted by the Seventeenth Game Conference in New York last December was the most progressive step in game conservation during this century. The manner in which the policy has been accepted generally is most encouraging. The longer one studies this policy the more comprehensive it becomes. Since the League had a representative on the committee which drafted that document, I hope this convention will formally endorse it so that the chapters and divisions will give the policy the support it deserves."

Commenting on research and surveys, he said: "Research and survey activities are gaining momentum rapidly. The report by Aldo Leopold covering his work of the past two years in the eight north

central states is the first thing of its kind in America. The game research work is going forward rapidly, and we will soon be able to develop our programs based upon actual knowledge instead of taking pot shots in the dark. The manner in which educational institutions are responding to the need for scientific workers is very encouraging."

Gordon then spoke of Coleman's experiment, saying: "The outstanding success of W. B. Coleman and his principal supporter, Mr. E. G. Baetjer of Baltimore, in the rearing of quail by electrically operated incubators and brooders is one of the marvels of the age. To see his birds and his equipment as I did is bound to give anyone a thrill. He has contributed enormously to the solution of our game problems, and I predict that he will solve the grouse rearing problem, if anyone will. The first of the season's grouse was laid last Saturday by a bird reared with the electric incubator-brooder method."

On problems confronting sportsmen, he said: "It is evident that at last the sportsmen are willing to give game conservation and production some serious thought. They want public hunting, and they want it as near 'free' as possible. Recent legislative attempts in New Jersey and North Carolina clearly indicate that the American sportsmen will not stand for the sale of wild game, but they will agree to compensate landowners who actually produce a game crop for the privilege of hunting it.

"The North Carolina law is a step in the right direction but large public areas must not be overlooked. Ultimately our hunting in America will fall into four classes:

1. Vast areas purchased by the public for use as refuges surrounded by public hunting and fishing grounds.

2. Still larger areas set aside for the exclusive use of those who are willing to pay the cost of an intensive game program, with special inducements to rear game.

3. Considerable areas in thickly populated sections operated under State supervision as daily-fee hunt clubs open to the general public.

4. The remainder, always the large bulk of our lands, a sort of 'no man's land' where no concerted effort will be made to produce game and where the crop will invariably be sparse."

The next part of his address had to do with funds which he says are the biggest need, and he continues: "The first of these plans requires ample funds. The present \$12,000,000 a year spent for game and fish is only one-half cent per acre—and we spend \$650,000,000, according to the Senate Committee, to harvest the crop. Until we spend at least \$50,000,000 to \$60,000,000 per year to maintain the crop we cannot hope to make much progress. Absolutely free shooting soon means no shooting. We must provide funds by one method or another, or else have no shooting worthy the name.

"Our federal agencies must have far greater appropriations for wild-life conservation. We must quadruple our staff of federal game protectors and stop this commercial slaughter and bootlegging of ducks; we must push our refuge system far more rapidly; we must find a way to go over and help Canada to save the breeding grounds of the ducks on the Continent. And until our present restrictions on legitimate shooting can be enforced adequately, it is foolish to suggest others. Let us as sportsmen stand shoulder to shoulder on these

propositions; let us each get our states to do their full share, and the funds with which to do the work will be forthcoming. But it takes work, and plenty of it.

"In conclusion, I would say there have been so many new developments in game conservation during the year that America's sportsmen are in about the same frame of mind as the chap who goes bear hunting for the first time. Every new proposal is like every crackling twig, every rustling leaf, presaging the approach of another bear. And finally the woods seem to be full of bears. By the time the real bruin comes lumbering within range chances are that the old trusty rifle will be forgotten and the bear will get away.

"This is no time for 'bear fever.' We need cool-headedness. I am convinced that thinking conservation leaders and sportsmen are not becoming panicky, and that out of the present maze of ideas will come the most progressive game program America has ever seen."

HOW HUNTING AIDED CELLINI

"Hunting as a sport is as old as the ages.

"Four hundred years ago Benvenuto Cellini, the Italian artist, wrote: 'It is true that the great delight I took in this exercise (hunting) bid fair to withdraw me from my art and studies; yet in another way it gave me more than it deprived me of, seeing that each time I went shooting I returned with greatly better health, because the open air was a benefit to my constitution. My natural temperament was melancholy, and while I was taking these amusements, my heart leapt up with joy, and I found that I could work better and with far greater mastery than when I spent my whole time in study and manual labor. In this way my gun, at the end of the game, stood me more profit than loss.'"—*Detroit News*, Detroit, Michigan.

VOLUNTEER DEPUTY REVIEWS CONVENTION

As the two previous conventions of the volunteer deputies had been held in San Francisco, it was deemed logical to hold the third in the southern part of the State to enable many deputies, heretofore unable to attend the northern meetings, to have the privilege of hearing the heads of the various departments and to receive advice on the enforcement of the State fish and game laws.

Conventions, such as these, go a long way in the overcoming of incorrect procedure, wrong interpretation of the intent of the game laws, lack of understanding by the deputy, the sportsman conservationist of the excellent accomplishments to date, and many other conservation problems.

Owing to the unfortunate illnesses of both Commissioner C. R. Bell and Assistant Chief of Patrol Charles Bauder most of the duty of welcoming the deputies and officials fell to the lot of volunteer Deputy Captain R. E. Jeffries.

Major John L. Farley, executive officer of the Division of Fish and Game, spoke on the necessity of cooperation, both in regular and volunteer forces.

E. L. Macaulay, chief of patrol of the regular deputies, explained the close tie existing between the present regular deputies of the division and the volunteer forces, and how in many sections of the State

their mutual helpfulness results in the making of cases which would otherwise be lost.

Walter R. Welch, captain in charge of volunteer deputies, emphasized the necessity of the furtherance of establishment of quail sanctuaries throughout the State, and added, that he hoped another year would see at least 1000 of these inviolate refuges serving, instead of the 700 at present.

August Bade, superintendent of the State game farms, spoke on his experiences during years of game bird propagation work. He answered the query of "why the raising of pheasants instead of quail," by saying that the quail does not compare with the pheasant (certain breeds) in the number of hatchings nor eggs per year. He said that the electric brooders were fast replacing the good but unreliable hen in game raising.

J. S. Hunter, in charge of game refuges, was unable to be present, owing to illness in his family.

The many activities of the bureau of hydraulics was described by J. Spencer, in charge of that office. Spencer solicited the assistance of the volunteer deputies in locating the sources of pollution, and, said that E. A. Chan, located in Long Beach, is ever available and capable of coping with problems in this end of our State.

George Tonkin, U. S. Game Protector, was present and spoke on fish and game problems from a national and international standpoint.

"The Value of Nongame Birds" was the subject chosen by Leo K. Wilson, head of the bureau of education and research. He advised that the education department has available a most reliable and comprehensive library.

Although Governor James Rolph, Jr., found it impossible to attend, many notables throughout the State were present.

The annual pistol competition was held at the police range in Elysian Park. James Davis, expert two-gun marksman, instructed all present in the proper handling of a pistol, and the laws regarding its use. Davis and Dr. George F. Fiske, Jr., U. S. Olympic shot, held a competitive match. This match was so nearly perfect that at the end both men had won and lost approximately equally in the various styles of shooting. To these experts anything outside the nine ring was a bad shot at fifty yards.

After this match, exhibition shooting was done by both, such as, shooting the ash off cigarett with guns upside down, shooting two targets, with a gun in each hand, and making tens on both targets at once.

In deputy target competition, Donald Maclain won a genuine deer skin specially tailored coat, donated by deputy Art Lenkeit as first prize. Deputy J. M. Bush won a \$55 double sleeping bag air mattress. A \$35 Divine fishing rod, a lambs wool sleeping bag, and a mounted 15 point Kaibab deer head, even to prizes for the ladies of velour auto cushions, comprised a list of most desirable prizes. The Walter R. Welch perpetual trophy was won by Deputy Maclain.

Much credit is due the Los Angeles deputies for the able manner in which they handle convention affairs—D. Foss, Venice, California.

NATURE HATCHES EGGS

A bird that displays something of the languor of the tropics is described by Dr. T. A. Jaggar, director of the Hawaiian Volcano Observatory. The malau bird, a unique inhabitant of Niuafoou, one of the Tonga Islands, digs a hole three to five feet deep in the slope of the warm volcanic sand, lays her long, pink egg in the bottom, scratches her way out, filling the hole behind her with sand, and lets nature do the rest. The sun heats the sand to from 85 to 95 degrees Fahrenheit. If the natives do not molest the egg and it is allowed to hatch, the young bird digs it own way out. The egg is the size of that of a goose. In another effort to save labor, different hens reoccupy the same holes over and over.—*Science*, Vol. 73, No. 1897, May 8, 1931, page 14.

FOREST SERVICE ESTABLISHES PRIMITIVE AREAS

In order to preserve for the public the conditions which existed in the pioneer phase of California's development, sixteen tracts, termed "primitive areas," embracing 1,744,412 acres in fifteen national forests of the California Region, have been designated by R. Y. Stuart, chief of the U. S. Forest Service, according to notice just received by regional forester S. B. Show. These areas are part of the wilderness country of the Sierra and Coast Range, and except for trails and such roads as are necessary for fire protection and administration, no permanent improvements of a recreational nature will be permitted.

"The recreational resources of the national forests of California are being utilized to such an extent that some action must be taken to provide areas where truly natural conditions can be found," stated Mr. Show. "Much of what a few years ago was wilderness is now given over to highways with summer resorts, auto camps and gas stations. The camper who desires a vacation in the real wilderness will now be assured of vacation grounds where environment, transportation, habitation and subsistence are almost the same as when the first white settlers came to California."

The primitive areas established by the Forest Service are as follows:

Agua Tibia—25,910 acres, in the Cleveland National Forest, including part of the Agua Tibia range and peak of that name. From these mountains wonderful views can be obtained of the desert and ocean.

Caribou Butte—16,442 acres, in the Lassen National Forest. This is a region of volcanic buttes with many interesting lava formations. Elevation from 6000 to 7000 feet.

Cucamonga—5000 acres, in the San Bernardino National Forest. A region varying from rolling benches to steep cliffs, immediately adjacent to intensively used recreational centers. Elevations from 5000 to 9000 feet.

Desolation Valley—41,380 acres, in the Eldorado National Forest. Located in a high Alpine country of granite peaks and skyline lakes, with elevations ranging from 6500 to 10,120 feet.

Dana-Minarets—82,181 acres, in the Mono and Sierra National Forests. A portion of the Minaret Range, including Mt. Dana, 13,050 feet, and Mt. Lyell, 13,090 feet, a region of perpetual snow, with gorges, mountain meadows, glaciers and glacial moraines, form the main features of this High Sierra country.

Emigrant Basin—98,044 acres, in the Stanislaus National Forest; on one of the routes of the covered-wagon pioneers. An area of rugged granite peaks, the highest being Leavitt Peak, 11,575 feet.

High Sierra—761,790 acres, in the Inyo, Sierra and Sequoia National Forests. A region of perpetual snow with many mountain lakes; the headwaters of the Kings River and other streams. Typical High Sierra country with elevations from 4000 to 14,000 feet, and many peaks above 12,000 feet.

Hoover—20,540 acres, located in the Mono National Forest along the crest and east side of the High Sierra. Contains many mountain lakes, meadows and numerous peaks over 13,000 feet elevation.

Marble Mountains—237,527 acres, in the Klamath National Forest, so called because of the limestone formation which resembles white marble. A high wilderness country with many lakes and streams.

Middle Eel-Yolla Bolly—143,386 acres, in the California and Trinity National Forests. Located on the headwaters of the Trinity River and smaller streams. A country of virgin forests and rugged topography with several high peaks.

Salmon-Trinity Alps—196,420 acres, in the Klamath, Shasta and Trinity National Forests. A region of granite peaks ranging from 7000 to 8000 feet, with remnants of former glaciers and showing the results of glacial action. Contains many Alpine lakes and streams.

San Gorgonio—20,000 acres, in the San Bernardino National Forest along the summit of the San Gorgonio Range. Elevations vary from 7000 to 11,485 on San Gorgonio Peak, the highest mountain in southern California. Topography rough and broken and in some places precipitous.

San Jacinto—23,291 acres, in the San Bernardino National Forest. A picturesque region surrounding San Jacinto Peak, 10,805 feet, from whose summit can be seen a wide view of mountains and deserts.

South Warner—70,682 acres, in the Modoc National Forest. Located on a high ridge, 15 miles long, overlooking the Nevada deserts. This ridge is a "fault" which resulted in the formation of the Warner Mountains. There are many glacial lakes and peaks over 9000 feet.

Thousand Lake Valley—16,335 acres, in the Lassen National Forest. A rugged timbered area surrounding McGee Peak, containing many lakes scattered in the pine and fir forest.

Ventana—45,520 acres, in the Monterey Division of the Santa Barbara National Forest. A rough country with elevations from 1200 to 4800 feet on the headwaters of the Carmel and Big Sur rivers.

RATTLESNAKES ARE BORN

Rattlesnakes afford a never ending source of interest to readers of the news. This is probably due to the fact that these reptiles carry death dealing poison fangs in their mouths, and everyone is interested in agencies that involve life and death. At Firebaugh, in Fresno County, someone has brought up the subject of "rattlesnake eggs." A story printed in the *Fresno Bee* says that scientists settled this question some time ago. That is, after prolonged observations, it was determined that little rattlesnakes are born and NOT hatched from eggs.

ROCKY MOUNTAIN SPOTTED FEVER NOT CONFINED TO PACIFIC NORTHWEST

A disease of the Rocky Mountain spotted fever type has been identified by the United States Public Health Service as occurring in states in the eastern and southeastern sections of this country. Until recently, it has been thought that Rocky Mountain spotted fever existed only in the western part of the United States, showing its greatest prevalence in Montana and adjoining states. There is every reason to believe that the type of the disease just reported for the eastern and southeastern states is spread by ticks, as is the type of the disease that is found in the Rocky Mountain section of the country. This disease is severe in some of the northwestern states, the mortality running from 60 to 90 per cent.

FLEAS MAY TRANSMIT ENDEMIC TYPHUS FEVER

The United States Public Health Service reports that there is strong evidence to indicate that, in this country, fleas may be the means of transmission of typhus fever from person to person or from a possible rodent reservoir to human beings. It has been known for many years that the old-world type of typhus fever is transmitted by the body louse. Study of a milder type of this disease which is found in the United States indicates that the body louse may not be involved in the transmission of the type of disease that is found in this country. The result of this study is of considerable epidemiological importance to public health authorities in California and in other states as well.

INSECTS HIBERNATE LIKE BEARS

Insects that survive from one warm season to the next, sleeping through the winter like bears, prepare for the winter very much as bears do, by increasing the body store of fat. They further insure survival by getting rid of as much water as possible, making their body fluids difficult to freeze to the point of crystal formation, which would have fatal effects. Hibernating insects will freeze to death if their environmental conditions are disturbed, whether they are prepared for the cold or not. These are, in skeleton outline, the results of experiments by N. L. Sacharov, of the Agricultural Experiment Station at Saratov, U. S. S. R. They are set forth in a full technical paper in English in the American scientific journal *Ecology*.—*Science*, Vol. 73, No. 1889, March 13, 1931, page 14

WOOD TICKS CARRY DISEASE

Beware of the wood tick. These unpleasant, repugnant bugs are common carriers of disease. Most assuredly no person would care to harbor one as a running mate, but few of us think about the disease-carrying propensities of the tick.

The disease of tularemia is the main danger in this section of the continent and is usually contracted by human beings through the tick-carrying rabbit. Other small animals may also carry infected ticks.

Needless to say as soon as one feels a crawling foreigner upon his body he should remove the object as soon as possible. In case of infection, seek expert medical aid immediately.

DIVISION ACTIVITIES

BUREAU OF FISH CULTURE

The protracted drought has caused incalculable damage to the fresh water fish in California, particularly the trout. Despite the effort of our crews, wardens and others the loss of trout in the Sierra Nevada mountains has been severe. Not only have many fish perished, but the low condition of the water in many lakes and streams has caused the fish to gather in small pools where they fall an easy prey to their natural enemies as well as to many fishermen who took advantage of the situation.

Experiments are still being made in the trout hatcheries with several brands of prepared fish food, but to date no substitute has been found for the regular foods that can be considered a balanced food for the fish. Some of the preparations may be used part of the time, thus reducing the expense of purchasing liver, melts, etc., which are a balanced food when properly fed. We hope to make a full report on this subject before long.

The water level in Lake Tahoe is about the same as it was early in July, while the water in the Truckee River and all streams flowing into the lake are somewhat lower. The water level in the lake is up to the rim as established by the head gates in the Truckee River and a small amount of water could be drawn off if the gates were open. There is still some water being drawn into the river from Donner Lake, but the lake level is becoming quite low and the flow of water through Donner Creek will not last much longer.

Snow Creek Station is being studied with the object of installing a filtration system as the Bureau of Sanitary Engineering discovered pathogenic bacteria in the water of Snow Creek. This condition is not due entirely to the contamination of the water from the ponds as a larger bacterial count was found above the hatchery than below it. A filter system will soon be installed that we believe will remedy the condition.

The water in Benner Creek failed early in July, the first time in the history of the State. We are now sinking a well with the object of having a water supply should the protracted drought continue, as well as to enable us to get water by pumping should we have another freezing spell as we did last winter when it froze the creek up for several weeks. We hope these conditions will not occur again, but are preparing for any emergency of a like nature.

Basin Creek, Big Creek, Brookdale, Prairie Creek, Fort Seward, Almanor and Wawona hatcheries have had such a shortage of water that they could operate but for a short time this spring. The low warm water has, at a majority of the hatcheries, caused them to plant earlier than usual. The hatcheries that are in operation are all running on diminished supplies of water and it will take more than one winter of normal precipitation to give the streams and springs their usual supply; as the drought has continued so many years that it will take several years to restore the lakes with water to bring up the flow any-

where in California so that we can have the same amount of water as was to be found in the springs and streams fifteen years ago.

BUREAU OF FINANCE

August was a very busy month in all of the Division offices and particularly at Los Angeles. Although clerks in the southern office received some help from one of the deputies, it was necessary for them to labor from early in the morning until evening in order to keep abreast of the work. This same condition existed throughout the month of September.

The reason for such a rush for licenses is due to the excellent deer season now in progress. With the animals in plentiful numbers throughout the State the hunters have taken advantage of the opportunity to secure outdoor recreation and a change of diet.

BUREAU OF GAME REFUGES

Water conditions on the Los Banos Waterfowl Refuge are poor. There has been very little water available for irrigation in the district and hundreds of acres of cotton planted near Dos Palos have not had a drop of moisture. It is not likely that water will be available in the ditches until after the seasonal rains.

On account of the low water conditions on this refuge it was decided, in order to take care of other dry years, that we should put down a well of sufficient size and depth to furnish an emergency supply. It is interesting to note that at 153 feet below the surface, 90 feet above sea level, that a 4-foot juniper log was found. Samples of this wood were turned over to the Forest Service for identification. Part of the wood had turned to coal.

At the Gray Lodge Waterfowl Refuge water conditions are satisfactory. Birds began to show in goodly numbers on both areas during the early part of August. By the end of the month there were thousands of birds on both areas.

It was reported that at the end of August speckled belly geese had shown up in considerable numbers. This is the earliest that this species has been reported.

The deer season opened in districts 2, 2 $\frac{1}{2}$, and 3 on the first of August. The daily record of tags of deer killed show a return of 5848 cards for the month as against 5958 for August of last year. This would indicate a kill of approximately the same as last year which was the heaviest year since the tag system was placed in operation.

During August, 17 lion bounty claims were filed. The same number were filed for August last year and this is five more than were claimed during the same month in 1929.

BUREAU OF PATROL

The first arrest under the new striped bass law was made in District 12 B, Sacramento River near Collinsville, on August 30. It is understood that some commercial fishermen have contributed towards the defense of this case and the entire affair will undoubtedly act as a test of the striped bass law.

The total number of arrests during August was 183 and the amount collected on fines was \$7,240; last year for this same period, 220 arrests were made with fines totaling \$8,212.

With the deer season open throughout the State the wardens have been very busy checking hunting licenses, deer tags, guarding refuges and performing many other important duties in the field.

The large number of forest fires in the State this year also presented many problems that vitally affected fish and game protection work and every cooperation was offered to both the Federal and State Forest Services to assist in dealing with the situation.

Our wardens have been and are very busy with fish rescue work. The continued drought has caused many live waters of California to become undesirable for fish life or to dry up entirely and in order to insure better prospects for coming seasons every effort was made to remove stranded fish to safe retreats.

Fish planting from the 29 trout hatcheries was also a very important problem this season and the wardens offered every possible assistance in this work.

BUREAU OF EDUCATION AND RESEARCH

All sections of California's open lands were represented this year in the exhibit of the Division at the annual State Fair in Sacramento. The fair lasted from September 5 to 12, inclusive.

The exhibit was erected under the direction of W. H. Shebley, in charge of the Bureau of Fish Culture. He has supervised the Division's State Fair exhibit for many years.

Sections depicted include the colorful rough lands of the south, the picturesque mountain country of central California and the wonderful redwood empire of the north. These representative territories were cleverly reproduced in the allotted space through the skill of W. F. Dabelstein, artist.

One entered the exhibit through the doors of a "log cabin." There, outside a great window, was a fresh water lake containing numerous trout. Beyond offered the great general scene. There were several waterfalls and numerous plants and trees, including the mysterious Joshua trees of the desert, in the exhibit and these gave a very natural color to the scheme.

The lighting effects were excellent. Through this medium the various changes of the day were made to appear. Not only that, but a typical mountain storm, with snow and moving clouds, was reproduced. Then, there was a great moon which shimmered on a distant lake after the storm had passed. This part of the exhibit was controlled by Edward Holtzmueller.

Glass aquariums were stationed at each entrance, enabling visitors to make close observations of our trout and spiny-rayed fish.

The exhibit was one of the best at the Fair, according to directors, and attracted thousands of persons.

Statistics were compiled of the hunting accidents which occurred in 1930. These figures are obtained from the clippings received from newspapers throughout the State. This compilation shows that 127 accidents occurred in 1930; statistics appear in detail in the reports at the back of this issue.

Various trips have been made by members of the Bureau to study field conditions, diseases among birds and game, and other important problems.

Lecture activities are being carried on at full capacity and Jack Boaz was added to the staff in order to properly care for this work in southern California.

BUREAU OF HYDRAULICS

Drought conditions have made the work of this Bureau exceedingly complex during the past few months and many inspection trips have been made into the field in an endeavor to make the work of conservation as effective as possible.

An inspection trip was made to the upper Truckee River and the main Truckee River. The upper Truckee was not flowing over about 40 inches of water. No water was flowing out of Lake Tahoe into the Truckee River and the water in said river was purchased from Donner Lake by Nevada interests, said water being used for domestic purposes and to keep flumes from drying out too much. Reports, which it is believed are reliable, are to the effect that great numbers of fish were killed at the Derby Dam on the Truckee River below Reno, Nevada. The Truckee River in the State of Nevada side is not flowing but merely standing in pools.

Water pollution problems in various parts of the State are being studied and much active and effective work is being done along this line.

BUREAU OF GAME FARMS

The planting of ring-necked pheasants for the month of August totaled 2191, with 227 valley quail and 28 Mexican bronze turkeys also turned into the fields.

A fine exhibit of game birds was furnished for the Sebastopol Apple Show and a similar exhibit was sent to the San Joaquin County Fair at Stockton. The game bird exhibit at the California State Fair in Sacramento attracted a great deal of interest and attention and some fine comment has been received.

Quite a few returns on the eggs sent out for hatching are coming in and many of them are very encouraging. The sportsmen at Petaluma turned out 400 nice birds as a result of their efforts. Deputy E. W. Smalley, of Hanford, reports that 575 birds were released at the age of ten weeks from 1440 eggs furnished them. In almost every case these people are asking for the same service next year and want additional eggs.

Reports on turkeys in Mendocino and Humboldt counties indicate that the birds are taking hold even better than expected.

Work on the game farm at Chino, in southern California, is running at full capacity and sportsmen and sportsmen's organizations are taking a great interest in affairs. Plants are constantly being made in that part of the State and great care is being taken to see that the land is suitable for the species introduced.

BUREAU OF COMMERCIAL FISHERIES

During the month of August sardines were very scarce in Monterey Bay and the sardines which were taken for the canneries were taken mostly outside the bay and above Santa Cruz. Ordinarily, sardines are most plentiful in Monterey during the month of August and September. This scarcity of sardines in the bay is associated with

abnormally warm water and the appearance in rather large numbers of unusual fish, such as barracuda, bonito and yellowtail. Mackerel and white sea bass were present in larger numbers than usual.

Sportsmen have been complaining that these game fish are becoming scarce in Monterey Bay and contend that this scarcity is caused by the taking of such large quantities of sardines for the canneries that there is not sufficient food left to bring the game fish into the bay. The abundance of game fish during an unusual scarcity of sardines apparently disposes of the sportsmen's theory. Our records of the commercial catch show that at the times barracuda are taken in the bay, bonito and white sea bass are also taken, and sometimes yellowtail. It is more reasonable to believe that the presence of these game fish in Monterey Bay is due to oceanographic conditions and that the abundance of sardines has little effect.

Another effect of the high water temperatures on the coast of California is the appearance of Mexican fish well up along the California coast. Heretofore swordfish have mainly been taken commercially off the coast of Lower California, but this summer there have been more of these fish taken off the coast of California than ever before. Nearly 150 swordfish had been taken near Catalina Island by the end of August, as compared with only 16 the entire season of last year. These Catalina swordfish were taken by pleasure anglers.

A great many tuna were brought into San Diego and San Pedro during August. The new tuna size limit law went into effect on August 14 and all incoming loads of the fish were inspected.

The high temperature of the water along our southern coast has diminished the size of the kelp beds, and some beds which are ordinarily quite large do not even appear on the surface.

The *Bluefin* has been very busy on patrol work. Early in August she made a patrol trip to San Diego, on which trip she brought back from that port the drag net which was taken near Oceanside some time ago.

The work of E. C. Scofield on the *Bluefin* in determining the spawning areas and drift of young sardines was brought to a close and he has returned to the Hopkins Marine Station at Pacific Grove.

Salmon investigation work on the Shasta River is showing very good progress. Merrill W. Brown, Junior Fisheries Researcher, reports that, to date, "we have counted 12,401 salmon through the Shasta counting racks, as compared with 355 at the same date last year. This season about 20 per cent of the run are grilse as compared with 60 per cent a year ago.

The counting method that is being used on the Shasta River this season is working very well. The river is clear and the research men can distinguish the fish very easily.

BUREAU OF FISH RESCUE AND RECLAMATION

It's an ill wind that blows no good! While the prediction that the lack of rainfall would be disastrous to fish life, and no doubt will be before rain falls again, at least in the Sacramento and some portions of the low San Joaquin valleys, it has been a blessing in disguise. It has been the practice of some of the gold dredgers in the Folsom areas to discharge the tailings into the local creeks. In some years of normal rainfall, this slush is carried into Elder Creek thence into the Hood

Canal and Snodgrass Slough, which are the spawning grounds of thousands of black bass, crappie, perch and sunfish. Last season this red soup appearing liquid destroyed every fish and egg in its path. This season, owing to the lack of rainfall, this deleterious substance reached but a small portion of the spawning grounds, consequently for the first 15 days of June of this year, this bureau has rescued 1,214,913 of the spiny rayed fresh water fishes in the same areas where but little rescue work was necessary last season. Of the above number 950,069 were black bass. All the waters from where the fish were taken were land locked. At this writing about 50 per cent of it is now dry ground.

To me and my net foreman, Abe Woodard, fish rescue work is most fascinating and interesting. When the nest of spawn is hatched, which in water of that temperature occurs in a few days, the young all rise to the surface, and from a distance the ten or more thousand little black bodies look like a mass of dark weeds. They remain in this condition for several days and are yet immune from the cannibal instinct of the parent fish and which still protect them. At this stage is the time we do the most efficient rescue work.

The one group of young fish may contain from ten to forty thousand. A large metal wash tub, with clean water, is placed on the bank near the water and with a six-foot square dip net placed carefully under them, the entire brood are lifted into the tub of water and hurried to the nearest permanent water which contains aquatic growth and water larvae in which the youngsters find food and shelter from their enemies. Later, when they attain a size of several inches, they can leave these water sanctuaries and paddle their own canoes.

Later the parent fish are seined out and returned to the water from where they came and if not caught, to return next season. In the States where these species are propagated in semiartificial hatcheries, the minimum of cost to propagate them is from \$25 to \$40 per thousand. It does not require much arithmetic to demonstrate the value of this piece of conservation.

VOLUNTEER DEPUTIES

In connection with the work being done by the volunteer deputies for the establishment of quail sanctuaries and game refuges in an effort to replenish the supply of quail through natural channels in open breeding grounds from the nucleus of wild birds in the field—a prize contest for the control of predatory birds and animals will be conducted, the terms of which are as follows:

To the volunteer deputy, who, between September 1, 1931, and March 1, 1932, sends to the office of the Division the greatest number of bobcat stomachs will be awarded a prize consisting of the choice of an E. C. Powell hand-made fly rod, or a Winchester rifle, donated by Mr. Albert Lindley of Stockton, and to the volunteer deputy, who, during the same period of time, sends to the Division the greatest number of stomachs and tails of sharp-shinned and Cooper hawks will be awarded a prize consisting of a genuine Navajo rug, donated by Volunteer Deputy E. W. Ross of Los Angeles.

To prepare the stomachs for shipment, remove them from the bird or animal, place them in a solution composed of one part formalin to ten parts of water. Allow to remain in the solution from 24 to 48 hours, remove, drain, mark the stomach and tail of each hawk

with a corresponding number, and mail to the Division together with your name and address, the date and locality where the bird or animal was killed, its species and sex.

In connection with this contest arrangements are being made to award a suitable prize to the volunteer deputy who, during the time of the bobcat and hawk contest, sends to the Division the greatest number of stomachs of the following species of birds and mammals: great horned owl, sharp-shinned, Cooper and duck hawks, crow, black-billed magpie, blue jay, opossum, coyote, bobcat and semiwild, roaming domestic house cat.

LIFE HISTORY NOTES

STRIPED BASS AT SAN DIEGO

Coburn F. Maddox, in charge of the San Diego district for the Bureau of Commercial Fisheries, reports under date of June 8, 1931, that he was informed three striped bass had been caught by anglers near La Jolla. He found one of these bass, a seven pounder, on display at the Stanley Andrews sporting goods store and learned that it was caught by Frank Dexter while surf fishing at the Scripps Institution of Oceanography. This report is of interest as it is the first verified report which has come to our attention of striped bass being taken south of Monterey Bay, although it is known that these introduced fish are becoming more numerous and have extended their range northward to Coos Bay in Oregon.—N. B. Scofield, 510 Russ Building, San Francisco, August 17, 1931.

STRIPED BASS

Howard R. Hill of the Los Angeles Museum reports the receipt of some striped bass, which were taken by sport fishermen at San Clemente, a small seacoast town in southern California. The specimens were young ones, around three and one-half inches long, and were reported to be "thick" in the region where they were taken. Local fishermen were unfamiliar with this species, and took specimens to Mr. Hill for identification.—Lionel A. Walford, August, 1931.

A PUG-HEADED RAINBOW TROUT

The malformation known as pug-headedness is uncommon but not rare among fishes. It is seldom that reliable information and good illustrations are brought to the attention of interested ichthyologists, however. The Division of Fish and Game has been fortunate in receiving a photograph of a deformed rainbow trout caught by Mr. Fred Hartzell of Susanville in Butte Lake, Lassen Volcanic National Park on June 21, 1931.

Dr. E. W. Gudger of the American Museum of Natural History has made a careful study of pug-headed fishes. In his published articles* he makes reference to a number of cases of the malformation which were brought to his attention. It appears to be most common among

* An adult pug-headed brown trout, *Salmo fario*, with notes on other pug-headed salmonids. American Museum of Natural History, Bulletin, vol. 58, art. 10, pp. 531-559, 1929.

Pug-headedness in the striped bass, *Roccus lineatus*, and in other related fishes. American Museum of Natural History, Bulletin, vol. 61, art. 1, pp. 1-19, 1930.

carp, although nearly all kinds of fish have been observed to be susceptible to the abnormality. The unusual appearance of the "forehead" can be noted in the embryo and is thought to be due to disturbances in the endocrine system. There are two general manifestations of the abnormality; the snout is flattened and depressed so the rudimentary upper jaw appears to have been forced downward and backward, or the premaxillaries are pushed back into the buccal cavity to form the roof of the mouth and the maxillaries are diminished in size and forced into a vertical position. The latter type of malformation is represented by Mr. Hartzell's specimen and is clearly shown in the accompanying photograph.



Fig. 135. Adult pug-headed rainbow trout taken in Butte Lake, Lassen Volcanic National Park, by Fred Hartzell, June 21, 1931. The malformation of the skull and upper jaw is rather uncommon among fishes. Photo submitted by Hartzell, August 15, 1931.

Most of the specimens on record are of immature fish, but the fact that some are full grown fish in good condition leads to the belief that feeding is not seriously hampered by the queer shape of the mouth. The Butte Lake trout was apparently in good condition and had attained to the weight of three pounds and six ounces.—Richard S. Croker, California State Fisheries Laboratory, August 15, 1931.

AN UNUSUAL RECORD OF THE BONITO (*SARDA CHILENSIS*)

Captain C. M. Bouton of the patrol boat *Quinnat* sent in a specimen of the California bonito (*Sarda chilensis*) taken in a shad net in the Suisun cutoff on May 12, 1931, by a commercial fisherman, by name Pete Volles. The California bonito ranges from San Francisco to Patagonia. It grows to a length of two or three feet and weighs from twelve to sixteen pounds. The usual food is anchovies and squid. The bonitos range the high seas in large schools moving up and down the coast with the changing seasons. The specimen in question may have become lost from its fellows, joined a school of shad and simply continued with them when they started up the river. As only the head and tail of the fish were sent in the size can only be guessed at. It was about 18 inches long.—Paul Bonnot, July, 1931.

KILLER WHALE IN CARQUINEZ STRAITS

On the afternoon of July 24, George Peters was with a party in a launch trolling for striped bass in Carquinez Straits off Benicia. The writer was in another launch nearby. Peters and some others were swimming when the whale was first sighted about one hundred yards from their boat. We thought it was a shark as all we could see was the long dorsal fin and part of the back as it appeared on the surface for a few moments. The swimmers boarded their boat and followed it. Peters had a rifle on board and whenever the whale appeared on

the surface he fired at it, firing about twenty shots in all. When it did not appear again, all came ashore, not believing any of the shots had taken effect.

About an hour later another fisherman found the body floating on the surface and towed it to the G. W. Hume wharf, where we hoisted it up on a pile driver.

There were many conjectures as to its identity at first, but it was positively identified through a description in the National Geographic Magazine and verified by two old whalers, who later viewed it, as a killer whale.

It was twelve feet six inches long, and, as nearly as we could estimate, weighed about 2500 pounds. It had sharp, pointed teeth in both the upper and lower jaws. The dorsal fin was about two feet long, and it was black with white underneath and over the eyes.

There were several others reported seen in the vicinity and there had been rumors that some large sharks had been seen in the

straits, so it is evident that a school of these killers found its way into the bay and had been mistaken for sharks.

We exhibited the whale for two days—two or three thousand people viewing it.

It was exposed to the hot sun and spoiled rapidly, so on the third day we towed it up in the tules and anchored it at high tide where it would not drift.



Fig. 136. Killer whale shot by fishermen in Carquinez Straits. The mammal was "playing around" near the new Southern Pacific Railroad bridge at Martinez. They are fast, powerful, savage and exceedingly predacious. Photo submitted by C. B. Williamson, Benicia, August 6, 1931.

Am enclosing a photograph taken when we first raised the whale, which may prove of interest. George Peters is at the left.—C. B. Williamson, Benicia, August 6, 1931.

On July 24, 1931, a 16-foot killer whale was killed near the Southern Pacific Railroad bridge at Benicia. Two Benicia fishermen, George and Matt Peters, brought the animal in after shooting it with a rifle. The killer whale (*Orca gladiator*) is primarily a whale of the open sea and this record is rather unusual.

The killers grow to be 25 or 30 feet long. The color varies, but is usually some combination of black and white. They have ten to thirteen strongly recurved teeth and a long, pointed dorsal fin.

Killers are predacious. They are fast, powerful and savage. They kill and eat the largest sea lion bulls and about the only animals in the sea which do not fear them are the sperm whales and full grown walrus bulls.—Paul Bonnot, 510 Russ Building, San Francisco, California, July 29, 1931.

TROUT AND WATER TEMPERATURE

Several investigators of the Biological Board of Canada have recently published articles dealing with their experiments on the rate of growth of trout in relation to the water temperature. They find that most trout can be hatched and raised successfully in a temperature of from 35 to 55 degrees Fahrenheit. One investigator records the breathing rate of his fish. At low temperature they breathe slowly, the rate rising with the temperature of the water until an approximate temperature of 80 degrees Fahrenheit is reached. At higher temperatures than this the rate of breathing slows down. A factor not mentioned by either of the papers is the oxygen content of the water at varying temperatures. It is a well known fact that the lower the temperature of the water the higher the oxygen content. This would account nicely for the fact that the fish breathe faster in warmer water than in cold and that after reaching an optimum temperature the fish would be partly stupefied by the lack of oxygen and slow down its breathing rate. The colder water required by trout, having a high oxygen content, would be conducive to the growth of good species as well as supplying the fish with plenty of oxygen, thus supplying the two main ingredients which would make for larger fish.—Paul Bonnot, July, 1931.

FALL SHORE BIRD MIGRATION STARTS EARLY

The south bound migration of shore birds began early this year. At Elkhorn Slough young willets, along with adults, put in their appearance in considerable numbers during the second week of July. On July 12, when I visited that section, I saw about seventy-five willets, about one-third of which were young birds. Also, a considerable number of godwits and the smaller sandpipers. There were two Hudsonian curlews also, but these were possibly birds that did not go north to breed. There were about forty northern phalaropes on a small pond nearby which had probably just returned.—D. D. McLean, 510 Russ Building, San Francisco, California.

BIRD WEAVES OWN NOOSE

While making motion pictures of the waterfowl on the State refuge near Los Banos during the early summer I chanced upon the nesting site of a cliff swallow colony under a bridge.



Fig. 137. Two blue cliff swallow fashioned its own noose. Photo by E. S. Chissey, May, 1931.

Noting the steady flight of the birds to and from some mud banks in the immediate vicinity I decided to investigate the manner of nest building from a very close point. The swallows appeared to form mud

pellets with their bills and then stick them in place on the under side of the rough boards with saliva.

After watching the "masonry" proceedings for an hour or more I intruded close enough to investigate the inner construction of the nests. The swallows seemed quite disturbed and voiced their disapproval with distressful cries.

While prowling around spying on the colony homes I discovered one of the swallows hanging limply below its home entrance. It apparently had been dead for a number of hours. Close observation revealed that one of its feet had become entangled in a section of horse-hair that was woven into the nest in such a way as to form a loop.

I noticed that the nest was lined with feathers, contained eggs and was otherwise in good order. Whether the other bird had deserted the nest following the tragedy is a question I was unable to ascertain at the time.—E. S. Cheney, 1825 Fifth Ave., Oakland, California, July, 1931.

CHIVALRY AMONG SQUIRRELS

During the month of April I was attracted by an unusual cry of a squirrel at Seacliff Park in Santa Cruz. The sound was more like an angry squeal.

Peering through an opening in some brush I saw two squirrels rolling in the dust in deathly combat. One animal was of the ground variety and the other a tree squirrel. Up on a post nearby another tree squirrel watched the proceedings with "feminine" interest.

Suddenly the tree squirrel broke from a desperate clinch, bounded a short distance up a tree trunk near at hand, then turned and glared at his adversary below. After a few seconds the tree squirrel leaped upon the back of his opponent and the battle waged with renewed vigor. Around and around they went unmindful of my slow approach to ringside.

This leaping attack was executed three times by the tree squirrel before victory turned in his direction. During the final stages of the battle the weakness of the ground squirrel became very apparent.

When his opponent was roundly thrashed and fatally wounded the tree squirrel released his hold, called his "fair damsel" from the post top and together they disappeared into the depths of the dark foliage.

After a few feeble struggles the ground squirrel expired. I did not see the start of the battle, or had no inkling as to the real cause, but from the attitude of the coy "miss" on the post top I have my convictions—yes, I have my convictions.—S. Ward, 34 Redwood street, Santa Cruz, California, July, 1931.

DEER APPARENTLY WANDER IN SEARCH OF WATER

During this, our driest summer, it has been noted that deer have been seen in the most unusual locations.

A spike buck was seen out in the middle of the Santa Clara Valley below Morgan Hill under an oak tree. Another spike buck was noted lying in the shade of an apricot tree just south of the Alum Rock avenue road, fully a mile out in the populated orchard section of the same valley. A doe was seen looking for water along Coyote Creek in the central part of the valley.

It is presumed that all these animals were in such peculiar locations due to lack of water in the hills.—D. D. McLean, 510 Russ Building, San Francisco, California.

WHITE QUAIL

An excellent photograph of a white or albino quail has just been received by Walter R. Welch, captain in charge of volunteer deputies, from Bert B. Williams of Coalinga. The bird is a fine specimen and a letter, accompanying the photo, reads:

In regard to the white quail, the one you have the picture of, is very much alive. I think it was three years ago when I turned this bird over to the university; they have it in Berkeley, I understand, and you can see it there.



Fig. 138. Albino or "white" quail are always a source of interest to naturalists. Several specimens of these birds have been noted on a ranch near Coalinga. Photo submitted by Bert B. Williams, July 30, 1931.

This white quail is five years old. The bird is tame and was sitting on a pencil when the picture was taken. I noticed these white quail for the first time about five years ago. There were twenty-two of them. When I stocked up the farm with quail I noticed a pair of white ones in the covey. Now there are quite a few white quail on my property.

There are also some of them in White Creek. I don't know why these birds are white. I understand that the white quail at Berkeley is doing very well.

I notice that some of the young quail this year have quite a few white feathers so I may discover another covey of them next year.

CRABS AND SPINY LOBSTERS

On June 8, 1931, Coburn Maddox reports that, while at San Onofre a few days before, he found quantities of broken pieces of lobster shells which had washed onto the beaches. It was evident that a large number of lobsters had recently gone through the moulting process.

Observations of this sort, with accurate dates, are of great value in gaining a knowledge of the essential facts in the life history of our shellfish and we hope others will send in reports of this sort. Lobsters and crabs in any one region moult at a fairly definite time each year but the time may be quite different in different localities. The moulting of crustaceans is usually associated with the time of breeding and has a bearing on the question of what is the proper closed season. From just such observations, it was found that the market crab moults or sheds its shell about a month later near Eureka than it does near San Francisco, and that is the reason the crab season is a month later at Eureka. Do not hesitate to send in your observations for fear you will be only repeating what is already well known, for there is a lot we do not know about our commonest and most important fish and shellfish.

On June 4, 1931, Captain Antonio Sabella, of the San Francisco Crab Fishermen's Association, reported that he had recently seen the market crab, *Cancer magister*, in the process of moulting. The crab was seen buried in the sand in the edge of the water at the extreme of a low tide, on one of the beaches near San Francisco. The cast shell was mostly above the sand, while the soft-shelled crab was in the sand just beneath it and not yet entirely out of the old shell. The market crab is adapted for covering itself in the sand and, as it is almost helpless for a time after moulting due to the softness of its shell, it is evident that this crab covered itself in the sand before the moulting process began and that the crab, instead of backing out of its shell, pushed the old shell up and out of the sand. The market crab is provided with areas of short hairlike processes on the front of its shell and on the inside surface of the appendages which bear the pincers, so that when the pincers are folded up against the crab's body, the hairy areas on the pincers meet those on the front of the crab's shell. In the process of breathing, the water is sucked in through this hairylike tangle and is thus freed of sand before the water is passed through the gill chamber. With this special adaptation, the crab is able to cover itself just under the surface of the sand so that only its stalk eyes protrude. Here it is supposed to lie in wait for any small fish or other animal to approach within striking distance of its powerful pincers. It is doubtful if this method of feeding has been actually observed. The crabs caught by our commercial fishermen are caught in traps to which they are lured by bait composed of fish. Knowing of the crab's habit of covering itself in the sand, it has been supposed that at the time of moulting it takes refuge in the sand. However, this observation of Captain Sabella is the only instance we know of where the moulting process of this species of crab has been observed.

A number of years ago we received frequent complaints that large numbers of dead crabs had washed ashore on the sand beaches north of San Francisco. Usually these were soft-shelled crabs, it was reported,

but frequently they were hard-shelled as well. Crab fishermen who made these reports claimed that the crabs were killed by the paranzella nets which are dragged over the bottom by large boats for the purpose of catching soles and sand dabs. These dead soft-shelled crabs on the sandy beaches of Marin County have been the principal cause of a feud between the crab and paranzella fishermen. In trying to learn more about this wholesale destruction of crabs, I ran across a very intelligent Norwegian crab fisherman living at Sausalito, who had on a number of occasions observed these dead crabs. I had found that some of the complaints were caused by the empty cast shells coming on the beaches, but this Sausalito crab fisherman stated that he had observed large numbers of dead soft-shelled crabs on the beaches. He was sure, however, that the paranzella nets were not responsible. He had observed, he said, that these dead crabs were always where there was a sand beach and not where the shore was rocky. He had also noticed that the destruction followed an extreme low tide and when a heavy ground swell was running. It was his belief that the crabs resort to the sand beaches just outside the breakers to cast their shells, and that if at this time, when they are in a rather helpless condition, a low tide and heavy ground swell causes the surface to break far out, the helpless crabs are caught and killed by the surf and left on the beach by the next high tide. He did not say if he knew whether the moulting crab buries itself in the sand or not, and we did not know enough about crabs at that time to ask him.

It is known that the market crabs pair at about the time of moulting but whether mating occurs just before the female sheds her shell or shortly after, as is the case with the blue market crab of the Atlantic coast, is not known. After fertilization, the eggs are carried for several months within the body of the female before they pass out and become attached to the swimmerets where they are protected under the broad tail flap. At the time the eggs are extruded and become attached under the tail, the female takes refuge in the sand. We learn this from observations made several years by former Deputy Ed. Moody who, when stationed at Santa Cruz, observed that Pismo clam diggers near Capitola occasionally mistake a small elevation in the sand in the edge of the water at extreme low tide for the hiding place of a clam. On pulling it out with their clam rake, it proved to be a crab. In each case the crab was a female, and under the tail flap and attached to the swimmerets was the mass of eggs which had been but recently extruded, as was evidenced by their bright reddish color. After reporting this at the San Francisco office, Mr. Moody at our request sent up a couple of specimens, which were for a time kept in a preserving fluid. Unfortunately, the label on these crabs was lost, so that we are unable to fix the date. The month was probably September or October, for the Pismo clam season was closed from May 1st to August 31st and the date must have been after the opening of the season on September 1st. We can be quite certain it was not just before the clam season closed, for that would be before the crabs shed their shells.



HUNTING ACCIDENTS, 1930

Number of persons killed	33	Nonfatal	18
Number of persons wounded, not killed	94	Occurred while hunting small game (rabbits, duck, quail, etc.)	15
Number of self-inflicted accidents		Fatal	34
Fatal	17	Nonfatal	
Nonfatal	58	Occurred while hunting unknown game	9
Number of accidents inflicted by others		Fatal	42
Fatal	16	Nonfatal	
Nonfatal	36	Number mistaken for game or other wild creatures	4
Occurred while hunting large game (deer, bear, etc.)		Fatal	
Fatal	9	Nonfatal	5

HUNTING ACCIDENTS, 1930—KILLED

Name	Shot by	Date	Locality	Circumstances
Arnerich, Sam (14)	Self	Nov. 23	Near Fairview	In pulling gun through fence by barrel, trigger caught on wire and discharged gun.
Barrett, John W.	Self	Feb. 28	Near Cannon's Resort	Found dead with rifle by his side, by searchers when he failed to return from hunting trip.
Betcharbs, Maurice (15)	L. Warner	Feb. 10	Almaden Creek Near Stockton	Squirrel hunting. Gun accidentally discharged killing Betcharbs.
Brady, Alex (31)	Unknown	Oct. 15	Hale's Crossing	Deer hunting. Accidentally shot by unknown hunter.
Calvin, Guy	H. Houx	Sept. 18	along Rubicon River Tehama County	Deer hunting. Believed bullet ricocheted from tree.
Coghlan, John J.	Self	Sept. 31	Near Buck's Springs Near Melones	Deer hunting. Rifle accidentally discharged as he was crawling over rocks.
Comber, George	Self	Jan. 15	Near Dixon	Duck hunting. He was pulling shotgun from back of the car. Trigger entangled with cords was jerked back, causing it to fire.
Coon, Everett A.	Self	Oct. 13	Fish Camp, Pt. Magee	Duck hunting. Gun accidentally discharged as Coon was entering auto to return from trip.
Dobbs, Chas. E.	Self	Nov. 23	Mariposa Co. 30 mi. E. of Oceanside	Return from hunting trip when gun discharged in removing it from machine.
Elkenshoffer, Ruth	Self	Feb. 15	Near Palmdale	Rabbit hunting. Gun accidentally discharged.
Forderer, G. S.	Self	Dec. 14	10 mi. E. of Fairfield	Duck hunting. Gun discharged while climbing out of barrel blind.
Gammon, Walter P.	Self	Dec. 25	Turlock Reservoir	Duck hunting. While in rowboat, gun accidentally discharged.
Grossman, Wm.	Self	Oct. 5	Old River San Joaquin Co.	Duck hunting. Boat upset while they were repairing damaged motor.

Hale, Lemar	Self	Dec. 18	Santa Ana Canyon	Rabbit hunting. Viewing valley from steel tower of Edison Co., when gun accidentally touched live wire. Was instantly electrocuted.
Houghton, A. W.	Self	Sept. 21	Near Bald Rock Tehama Co.	Gun was leaning on rear fender of car, fell and was discharged, bullet striking car door and rebounding, hitting Houghton.
Johnson, Robt.	R. T. Goldsmith	Jan. 2	Taft, Calif.	Shooting accidental. Goldsmith, carrying 22-caliber rifle. Shot at hawk, but hit companion.
Kwartz, Ben	Paul Huryck	Nov. 28	Near E. Oakland	Deer hunting. Mareto was mistaken for a deer.
Maretto, Paul	Emmett Shearer	Aug. 19	Santa Rosa, Marietta Rch.	Returning from hunting, Black was attempting to put safety catch on rifle when it exploded, the bullet striking young Marshall.
Marshall, H.	John Black	Aug. 9	Mortimer Park	ing young Marshall.
Miller, Elmer	Wm. Ridge	Dec. 16	Pyramid Rock	Bear hunting. In attempt to rescue dog from bear, companion unexpectedly fired at bear.
Mulligan, Chas.	Unknown	Sept. 18	Near Lakeside	Deer hunting. Source of shot unknown; believed to be stray bullet from another hunter.
Mulvey, Cyril	E. Robb	Feb. 16	Dry Lake, Kern Co.	Rabbit hunting. Robb, in taking shell from repeating shotgun, accidentally fired the piece and caused Mulvey's death.
Nelson, G. W.	Robt. Norton	Feb. 2	Near Buck Meadows	Hunting and trapping trip. Norton fell, his rifle accidentally discharging, and bullet striking Nelson.
Phillips, D. W.	Self	Aug. 10	Mariposa Co. Lake County	Deer hunting. Rifle discharged as Phillips was getting out of auto, bullet striking him and causing instant death.
Rasore, L. S.	J. Shaw	Dec. 29	Near Colusa	Goose hunting. Shooting accidental.
Renfree, R. J.	A. Silva	Oct. 15	Near Nevada City	Deer hunting. Accidentally shot by companion as he left "stand."
Ridgway, H. R.	Self	Sept. 9	Near Brawley	Dove hunting. Accidentally dropped gun, thereby shooting himself.
Rudick, John	C. Everett	Dec. 7	Near Los Banos	Duck hunting. Accidentally shot as he was pulling gun through fence.
Spencer, W.	Self	Sept. 28	Near Bayside	Rabbit hunting.
Stansbury, R. R.	Self	Nov. 20	2 mi. W. of Chowchilla	Rabbit hunting. Gun accidentally discharged from rear seat of car.
Watson, John	D. A. Shea	Dec. 25	Near Susanville	Goose hunting. Shea fired at flock overhead, but gun not aimed high enough causing bullet to hit Watson.
Wickham, F. F.	Self	Sept. 28	Kettlerock	Stumbled and fell, shooting himself through abdomen.
Williams, Arthur	Unknown	Oct. 3	Near Oroville	Deer hunting. Died of shock and hemorrhage resulting from gunshot wound inflicted by unknown persons.

HUNTING ACCIDENTS, 1930—INJURED

Name	Shot by	Date	Locality	Circumstances
Adams, Arthur	Self	Nov. 27	Near Live Oak	Duck hunting.
Amyx, Claude	Self	Jan. 10	Near Ahwahnee Madera Co.	A piece of flying metal pierced the eyeball when gun accidentally exploded.
Anderson, Louis	Self	Apr. 12	Berkeley Hills	Hunting with "home made" gun, which failed to explode, but in examining it, discharged.
Avery, James (23)	K. Atkins	Sept. 16	Alameda Co. San Jacinto Mts.	Deer hunting. Atkins' gun accidentally discharged.
Norman, Barker (14)	Self	July 18	Near Sonora	Rifle slipped off fender of car, striking ground and discharging.
Brazil, M. P.	Self	Mar. 23	Near San Gregoria San Mateo Co.	Magazine of rifle accidentally exploded.
Brand, Wilbur E.	Self	Nov. 2	Near Gridley	Placed shell of wrong caliber, which lodged in chamber and later, when other shell was fired, gun exploded.
Brown, Homer	A. Smith	Aug. 1	Colusa County	Deer hunting. Trigger of gun was snagged in brush and cartridge exploded.
Burdick, Clifford	Self	July 30	Near Turlock	Rabbit hunting. Accidental discharge of rifle.
Burnell, Canada	H. C. Swyer	Aug. 4	Bouquet Canyon, L. A. Co.	Rabbit hunting.
Bussey, Marion	Self	Mar. 27	Los Angeles County	Squirrel hunting. Rifle accidentally discharged when he stumbled on a log and fell.
Butts, Nolan (21)	Self	Dec. 10	Near Crows Landing	Quail hunting. Accidentally dropped gun.
Carr, Robert	H. A. Carnow	Dec. 23	East of Biggs	Quail hunting. Ejecting shells from gun accidentally discharged it.
Coffman, Glen	Unknown	Jan. 9	Near Maywood	Several boys together and rifle which one was carrying accidentally discharged.
Coghlan, John (40)	Self	Sept. 29	Near Sonora	Deer hunting. Placed rifle on rock and in climbing over it, rifle slipped and was discharged.
Colle, Dominick (15)	Self	Dec. 7	Point Reyes	Gun he was carrying accidentally discharged.
Conley, M. Neal (50)	Unknown	Sept. 22	Near Mineral	Deer hunting.
Contente, Herman	Self	July 13	Near Napa District	Hunting Jackrabbits. Party of 3 boys used one gun, and in passing it was accidentally fired.
Cordy, Chas. H.	Unknown	Dec. 14	Napa County	Quail hunting. In line of fire of other hunter.
Costillo, Joe (16)	Y. Soto	July 24	Near Compton	Rabbit hunting. Shooting accident.
Danley, George	Unknown	Nov. 27	Near Maxwell	Duck hunting. Fired in back by unknown hunter.
DeBorba, A.	Self	Aug. 10	Marin County Ignacio Gun Club	Deer hunting. Returning with deer, caught foot in a root on steep hillside, fell and broke his leg.
Dilloon, Lester (24)	Self	Sept. 31	Merced, Calif.	Deer hunting. Cleaning gun on return; rag caught the trigger.
Epkins, Roy (19)	Self	Dec. 15	Near Palmdale	Gun accidentally discharged.
Etter, Ira	Companion	Dec. 3	Richmond	Firing at sparrow, companion accidentally hit Etter.
Fiske, George	Self	Dec. 30	Rockaway Beach San Mateo Co.	Rabbit hunting. Shotgun accidentally exploded in his hands.
Fletcher, F. (45)	Self	Oct. 9	Near Standard City	Gun accidentally discharged.

Genazzia, R. (13)	Self	July 9	Near Penngrove	Crawling through fence, pulling gun after him, it was accidentally discharged.
Galloway, R. (16)	Robert Lundeck	Nov. 29	Near Los Angeles	Was mistaken for rabbit as only legs were visible moving through the brush.
Gillis, Jack	Self	Aug. 30	Near Jamesburg	Deer hunting. In attempting to back down a water course, slipped, dropped rifle, which discharged.
Graves, Paul (17)	Self	Dec. 14	Glendale	Stopped at restaurant and gun accidentally discharged when knocked down.
Gray, John T.	Self	Sept. 24	Near Quincy	Deer hunting. Shot at deer, bullet hitting rock and rebounding.
Grumelli, Louis	Self	Oct. 26	Redding	Attempting to adjust some mechanism when gun went off.
Gwinn, Willard	Self	Mar. 21	Near Oceanide	Gun fell from runningboard of auto causing it to fire.
Hildebrand, S. R.	Self	Aug. 28	Acampo, San Joaquin Co.	Reached for rifle to shoot, sparrows annoyed him, and in pulling rifle over head it was discharged.
Hindley, Lewis	Brother	Dec. 8	Near Bonsall	Quail hunting. Stepped into line of fire.
Hines, Chas. (16)	Companion	Oct. 4	Los Angeles County	Rifle carried by companion accidentally discharged.
Holmes, Henry	Self	Oct. 6	Shasta County	Deer hunting. Accidentally shot himself in right forearm.
Hoyle, Richard (19)	Self	Aug. 12	Stough Canyon	Gun resting against his leg and in turning to see who was coming, accidentally touched trigger, discharging gun.
Houghton, Anson (42)	Self	Sept. 19	Tehama County	Deer hunting. Rifle was leaned against car, fell to ground and was discharged.
Hugill, Douglas (18)	Fred Barnes	Sept. 26	Near Bald Rock	Hunting rats. Accidentally shot.
Jenkins, Geo. W.	M. T. Stansbury	Dec. 30	Martinez, Calif.	Quail hunting.
Kaiser, Roy C.	Self	Oct. 13	Near Chico	Fell and broke leg while on hunting trip.
Klein, George (17)	Self	Feb. 3	Near Acton, L. A. Co.	Squirrel hunting. Rifle fired accidentally.
Larter, R. E.	Unknown	Oct. 8	Alameda County	Duck hunting. Hit by stray bullet.
Lockeridge, M.	Self	Oct. 3	Cal. Gun Club	Duck hunting. Gun fell to ground snapping trigger.
Lyon, Henry	Unknown	Sept. 8	Colusa County	Accidentally shot while on hunting trip.
Manassero, John (22)	Unknown	Sept. 18	Near Silver Lake	Deer hunting. Mistaken for deer.
Mariante, Patrick	Unknown	Sept. 2	Near Silver Lake	Dove hunting. Shot by stray bullet.
McCoy, Edward	Brother	Apr. 12	San Bernardino Co.	Gun accidentally discharged when trigger caught in tall grass.
McLain, L. (11)	Self	May 13	Near Paso Robles	Rabbit hunting. Shot himself.
McPherson, Jerome (24)	Self	Sept. 16	Happy Valley	Deer hunting. Rested gun against tree, it fell and discharged.
Mercado, Joe	Self	Aug. 28	Madera County	Stumbled and fell, accidentally discharging gun.
Millard, Earl (15)	Self	Mar. 24	Laguna Junction Station	Rabbit hunting. Gun accidentally discharged while using butt to prod in a hole in ground.
Miravalle, Andrew	Self	Aug. 5	Near Beresford Park	Gun accidentally discharged while dragging it through brush.
Miro, George	Self	Oct. 20	Near Beresford Park	Duck hunting. Dragging gun across bottom of boat, trigger caught on carlock, discharging gun.
Mosely, Robert	Self	Dec. 17	Lake Washington	Duck hunting. Crawling over ground, gun accidentally fired.
Nelson, Mervin (14)	Self	Feb. 8	Yolo Co.	Apparently attempted to rest butt of gun on ground and received full blast under the arm.
Nelson, Geo. W.	Robt. Morton	Feb. 5	Near Cordelia	Morton slipped in snow, fell and his revolver accidentally fired.
			Solano Co.	
			Near Groveand	

HUNTING ACCIDENTS, 1930—INJURED—Continued

Name	Shot by	Date	Locality	Circumstances
Newland, John	Self	Dec. 3	Laguna Beach	Gun dragged against shrubbery, pulling trigger.
O'Brien, Harry (17)	Joe Macedo	Jan. 23	Alameda County	Rabbit hunting. Three boys together saw hawk, dropped to ground and in some manner Macedo's gun was discharged.
Ontiveros, F. (32)	Self	Oct. 20	Near Santa Maria	Reached into wagon for gun, sudden jar caused it to fire.
Olms, Otto (26)	Self	July 31	Near Sespe	Deer hunting. In removing gun from front seat of auto, trigger caught, discharging it.
Oursler, Don E. (36)	Self	Sept. 9	Near Elsinore	Shotgun propped against driver's seat discharged, probably caused by jolt of the car.
Parra, James	Unknown	Dec. 7	Babbs Canyon	Quail hunting. Shot in back by unknown person.
Phipps, Robt. (22)	Unknown	Aug. 31	Near Elsinore	Dove hunting. Hunting with three companions, not known who fired shot.
Price, Harold (24)	Self	Dec. 27	Near Healdsburg	Gun accidentally discharged.
Rapley, C.	Companion	Sept. 8	Sonoma County	Accidentally shot by companion.
Rattenburg, G. R.	Companion	Aug. 1	Yolo County N. of Winters	Twig from tree sprang back after companion pressed through brush, striking Rattenburg in eye, which was punctured by thorn.
Reese, Robert	Self	Jan. 1	Lake County	Rabbit hunting. Carrying revolver strapped to waist. Accidentally discharged.
Renfro, James (8)	Companion	Dec. 28	Santa Ana River	Rifle in hands of companion was dropped; in falling, discharged.
Roach, E. H.	Self	Sept. 11	Half Moon Bay	Stepped on gun as alighting from auto, discharging it.
Rock, Buddy	Self	Dec. 16	Burlingame	Dropped his gun, causing it to fire.
Romero, E.	Unknown	Sept. 12	Ontario	Working on fruit farm; hit by stray bullet, thought to have been fired by some hunter.
Rudspeth, Donald	Self	Dec. 15	North of Oxnard	Duck hunting. Shotgun accidentally discharged.
Samato, Joe (19)	Shide Nashumoto	Aug. 10	San Joaquin County	Boys were crawling under fence when Nashumoto's gun was accidentally discharged.
Schmidt, Roy (13)	Louis Morley	Jan. 4	Alameda County	Shooting birds.
Silva, Harold (17)	Self	Oct. 6	Near Bakersfield	Gun accidentally discharged as he was taking it from auto.
Simoni, Eugene (17)	Self	Dec. 3	Near Santa Rosa	Quail hunting. Leaned shotgun against fence and proceeded to climb fence, trigger accidentally touched and gun fired.
Stevens, Richard (21)	Self	Oct. 13		Gun accidentally discharged.
Stier, John (13)	Al Yost	Apr. 18		Yost picked up small caliber rifle and in fingering it, accidentally pulled trigger.
Stout, C. D.	Companion	Sept. 17		Deer hunting. Stout left two companions and entered thicket for wounded deer. Companion mistook Stout for deer.
Tammy, Charles	Self	Sept. 24	Lassen County	Deer hunting. Shot and injured five-point buck, using last of ammunition. Overtook deer, which reared and charged and in the fray, before killing animal, was hooked in left forearm and thigh.

Tate, Louis (17)	Self	Dec.	7	Near San Luis Obispo	Quail hunting. Resting muzzle on foot when it accidentally discharged.
Vargas, Manuel (19)	Self	Sept.	1	Near Turlock	Dove hunting. Accidentally discharged gun as he jumped from auto.
Vasco, Joseph (28)	A. Vincent	Aug.	11	Stanislaus Co. Tassajara	Deer hunting. Vasco was looking for field glasses which he had dropped and was mistaken for deer.
Whipple, Alva (15)	Self	July	8	Near Orland, Glenn Co.	Gun accidentally discharged in moving it to remove rear seat of auto.
Whitmire, Alvin (15)	Self	Jan.	15	Near Knights Landing Yolo Co.	Duck hunting. Accidentally cut right hand.
Wicking, Carl (44)	Self	Dec.	7	Near Hemet	Quail hunting. Tripped over rock and gun discharged.
Wilson, Roy	Self	Jan.	2	Van Nuys, Calif.	Cleaning gun, accidentally shot himself.
Winsby, Mervin (15)	Wm. Jones	Aug.	6	Reeves Canyon	Deer hunting. Mistaken for a deer.
Woods, Wm.	Self	Dec.	9	10 mi. S. W. Gustine	Goose hunting. Car parked on incline started rolling. In attempt to put on emergency brake while holding gun, trigger caught and gun fired.
Wright, W. C.	Wm. Crossland	Dec.	14	Near Fresno	Wright stepped into line of fire.
Young, Raymond	Companion	Dec.	28	Near Manteca	Rabbit hunting. Companion fired at rabbit, one of the birdshot hitting Young.

REPORTS

SEIZURES OF FISH AND GAME

Fish

April, May, June, 1931

Abalones	-----	pounds	493
Barracuda	-----	pounds	2,293
Bass	-----		
Black	-----		278
Striped	-----		180
Bluegills, crappie, perch	-----		441
Clams	-----		1,644
Corbina	-----		4
Croaker, spotfin	-----	pounds	15
Crayfish	-----		31
Grunion	-----		7
Shad	-----	pounds	550
Salmon	-----		12
Smallfish	-----		150
Trout	-----		2,066
Trout	-----	pounds	70
Traps (fish)	-----		24
Nets	-----		2
Tuna (Bluefin)	-----		24,144
Game			
Deer	-----		78
Deer meat	-----	pounds	407
Dove	-----		1
Grouse	-----		2
Pigeon	-----		1
Quail	-----		5
Rabbits	-----		30
Shorebirds	-----		3
Squirrel	-----		2
Nets, bird	-----		2

FISH CASES

April, May, June, 1931

	Number arrests	Fines imposed	Jail Sentences (days)
Angling License Act; violations of	121	\$2,091 00	48
Abalones; overlimit; small	74	1,975 00	---
Barracuda; small	6	135 00	---
Bass			
Black; closed season	25	425 00	---
Striped; small; closed season	36	560 00	10
Clams; small; overlimit	58	1,130 00	430
Corbina; selling of	1	---	---
Crabs; small	4	45 00	---
Crayfish; taking of in district 4	2	15 00	---
Crappie; perch; bluegill; closed season	23	385 00	---
Commercial Fishing License Act; violations of	12	105 00	---
Explosives; use of to take fish	2	400 00	---
Fishing near dam, fish ladder or too near mouth of stream	8	239 00	68
Grunion; closed season	1	10 00	---
Illegal fishing apparatus; gaff hooks, spears, etc.	16	310 00	---
Nets, seines; illegal use of	15	1,105 00	100
Night fishing	2	50 00	---
Pollution of streams	7	125 00	---
Salmon; closed season	1	50 00	---
Spotfin croaker; selling of	1	25 00	---
Sea lion; killing of	1	100 00	---
Trout; closed season; overlimit	86	2,445 00	25
Totals	502	\$11,725 00	681

GAME CASES

April, May, June, 1931

	Number arrests	Fines imposed	Jail Sentences (days)
Deer; closed season	61	\$2,654 00	548
Ducks; closed season	2	---	---
Grouse; killing of	1	25 00	---
Hunting License Act; violations of	13	228 00	6
Hunting in game refuge	4	59 00	1
Night hunting	3	100 00	25
Nets (bird); illegal	1	---	---
Pheasants; killing of	3	350 00	---
Pigeons; closed season	1	---	25
Quail; closed season	2	---	90
Rabbits; closed season	18	270 00	40
Shorebirds; killing of	1	25 00	---
Squirrel; killing of	1	---	1
Songbirds; trapping of	2	50 00	---
Totals	114	\$3,761 00	736

STATEMENT OF EXPENDITURES

For the Period July 1, 1930 to June 30, 1931, of the Eighty-second Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive	\$6,000 00			\$6 46	\$6,006 46
Clerical and office	21,581 22	\$974 22	\$607 51	561 57	23,724 52
Printing		18,849 57			18,849 57
Automobiles		331 74	190 96	1,503 90	2,026 60
Traveling			2,873 90		2,873 90
Postage			5,046 06		5,046 06
Telephone and telegraph			4,197 48		4,197 48
Freight, cartage and express			2,057 00		2,057 00
Rent			14,572 22		14,572 22
Heat, light and power			27 44		27 44
Accident and death claims			7,272 89		7,272 89
Accounting pro rata	4,500 00				4,500 00
Legal	6,600 00		333 15	177 55	7,110 70
Publicity			257 41		257 41
Total administration	\$38,681 22	\$20,155 53	\$37,436 02	\$2,249 48	\$98,522 25
Education and research:					
Chief and assistant	\$9,385 00			\$12 92	\$9,397 92
Clerical and office	1,920 00	\$342 65	\$282 85	347 58	2,893 08
Traveling			7,482 16		7,482 16
Telephone and telegraph			32 24		32 24
Freight, cartage and express			18 56		18 56
Photographer	1,200 00		68 00	1,182 15	2,450 15
Librarian	1,912 90	121 62	98 72	267 69	2,400 93
Research	8,638 71	487 67	2 00	9 75	9,138 13
Publicity			413 31		413 31
Exhibits			75 75	50 00	125 75
Temporary help	1,165 00				1,165 00
Summer educational work	546 68				546 68
Total education and research	\$24,768 29	\$951 94	\$8,473 59	\$1,870 09	\$36,063 91
Patrol and law enforcement:					
Chief and assistants	\$10,823 00			\$6 46	\$10,829 46
Clerical and office	3,057 50	\$347 21	\$16 80	120 86	3,542 37
Automobiles		9,298 47	4,014 89	14,157 68	27,471 04
Traveling			130,318 78		130,318 78
Postage			672 11		672 11
Telephone and telegraph			2,105 39		2,103 39
Freight, cartage and express			70 07		70 07
Rent			752 02		752 02
Captains and deputies	208,137 82	1,497 41	228 66	245 14	210,109 03
Launches	2,040 00	1,427 40	1,446 64	165 90	5,079 94
Fish planting	2,350 36	778 20	148 80	1,085 05	4,362 41
Volunteer deputies	885 00	46 19			931 19
Premiums on bonds			3,910 89		3,910 89
Temporary help	780 50				780 50
Heat, light and power			15 99		15 99
Total patrol and law enforcement	\$228,074 18	\$13,394 88	\$143,701 04	\$15,781 09	\$400,951 19
Commercial fisheries:					
Chief and assistants	\$12,270 00				\$12,270 00
Clerical and office	9,471 67	\$239 74	\$108 57	\$820	9,828 18
Automobiles		741 56	367 74		1,109 30
Traveling			21,236 27		21,236 27
Postage			6 17		6 17
Telephone and telegraph			484 12		484 12
Freight, cartage and express			259 60		259 60
Rent			927 50		927 50
Heat, light and power			293 18		293 18
Research	9,613 87	63 40	17 90	133 73	9,828 90
Inspectors	19,406 90				19,406 90
Captains and deputies	13,782 50	162 14	40 27		15,984 91
Launches	12,761 54	6,225 44	3,708 30	4,890 99	27,586 27
Laboratory	31,947 05	1,150 19	1,992 31	2,190 87	37,280 42
Blue printing			15 29		15 29
Fish tags		382 00			382 00
Salmon tagging			3 50		3 50
Botulism			15,000 00		15,000 00
Hydro-biological survey, Monterey Bay			1,500 00		1,500 00
Statistics	2,940 00	2,538 69	1,393 38	203 00	7,077 07
Publicity			1 05		1 05
Total commercial fisheries	\$114,193 53	\$11,503 16	\$47,355 15	\$7,428 79	\$180,480 63

STATEMENT OF EXPENDITURES

For the Period July 1, 1930 to June 30, 1931, of the Eighty-second Fiscal Year—Continued

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish culture:					
Chief and assistants	\$6,691 61		\$4 00		\$6,695 61
Clerical and office	3,972 58	\$91 80	18 43	\$63 00	4,143 81
Automobiles		5,431 38	2,577 20	8,697 27	16,705 85
Traveling			11,655 21		11,655 21
Postage			106 57		106 57
Telephone and telegraph			1,145 27		1,145 27
Freight, cartage and express			1,725 15		1,725 15
Rent			1,695 61		1,695 61
Heat, light and power			886 42		886 42
Hatcheries	137,016 58	71,160 24	1,572 00	2,064 41	211,813 23
Hatcheries—additions and betterments				53,762 59	53,762 59
Special field investigations	12,326 33	160 28	32 62	20 00	12,539 23
Fish cars	2,396 52	467 20	2,325 93	141 45	5,331 10
Blue printing			5 10		5 10
Cooperative research	10 00	11 61	32 40	741 99	796 00
Total fish culture	\$162,613 62	\$77,322 51	\$23,781 91	\$65,460 71	\$329,208 75
Hydraulics:					
Chief and assistants	\$7,200 00		\$3 06		\$7,203 06
Clerical and office		\$75 25	182 06		257 31
Automobiles		466 09	220 28	\$1,075 50	1,763 87
Traveling			1,953 10		1,953 10
Telephone and telegraph			8 89		8 89
Blue printing			14 09		14 09
Cooperative research	3,000 00				3,000 00
Postage			2 00		2 00
Publicity			2 52		2 52
Total hydraulics	\$10,200 00	\$541 34	\$2,386 00	\$1,077 50	\$14,204 84
Game propagation:					
Superintendents	\$7,865 00				\$7,865 00
Automobiles		\$446 34	\$202 64		648 98
Traveling			1,671 61		1,671 61
Postage			19 57		19 57
Telephone and telegraph			220 12		220 12
Freight, cartage and express			59 31		59 31
Heat, light and power			1,220 94		1,220 94
Maintenance		10,773 76	2,757 91	\$5,983 58	19,515 25
Temporary help	4,815 18				4,815 18
Assistants	4,440 00				4,440 00
Purchase of game birds		3,963 93			3,963 93
Total game propagation	\$17,120 18	\$15,184 03	\$6,152 10	\$5,983 58	\$44,439 89
Fish rescue:					
Chief and assistants	\$4,670 00	\$30 58	\$191 39		\$4,891 97
Traveling			1,978 51		1,978 51
Rent			238 00		238 00
Temporary help	353 00				353 00
Total fish rescue	\$5,023 00	\$30 58	\$2,407 90		\$7,461 48
Game refuge:					
Chief and assistants	\$4,000 00				\$4,000 00
Clerical and office	2,268 45	\$1 65	\$13 75		2,283 85
Automobiles		809 55	464 29	\$1,969 34	3,243 18
Traveling			1,754 32		1,754 32
Postage			49		49
Freight, cartage and express			50		50
Lion hunters and trappers	9,132 00				9,132 00
Refuge posting	6,660 82	4 80			6,665 62
Predatory animal control			7,290 00		7,290 00
Refuge maintenance	2,659 55	2,343 08	1,399 88	6,248 20	12,650 71
Telephone and telegraph			2 40		2 40
Publicity			8 20		8 20
Total game refuge	\$24,720 82	\$3,159 08	\$10,933 83	\$8,217 54	\$47,031 27
License commissions					\$59,225 00
Purchase lease and improvements of game refuges					133,417 00
State fair and other exhibits					4,995 55
Prior year expense—81st fiscal year only					4,023 32
Prior year expense—80th fiscal year only					4,821 87
Expenditures to pay claim of Fred F. Freitas—Chap. 403-29					10 00
Opening channel of Salinas River					2,433 47
Protecting the construction on the Russian River Jetty					11,959 11
Grand total, proprietary group					\$1,379,249 53

STATEMENT OF INCOME

For the Period July 1, 1930, to June 30, 1931, of the Eighty-second Fiscal Year

License sales	Detail	Total
Departmental income:		
Angling licenses, 1930	\$429,202 50	
Angling licenses, 1929	450 00	
Angling licenses, 1931	76,111 00	
Commercial hunting club licenses, 1930-31	2,110 00	
Commercial hunting club operators' licenses, 1930-31	620 00	
Deer tags, 1930	123,999 00	
Fish breeders' licenses, 1930	25 00	
Fish breeders' licenses, 1931	435 00	
Fish importers' licenses, 1930	10 00	
Fish importers' licenses, 1931	75 00	
Game breeders' licenses, 1930	142 50	
Game breeders' licenses, 1931	882 50	
Hunting licenses, 1929	100 00	
Hunting licenses, 1930	439,942 70	
Hunting licenses, 1931	24,342 00	
Kelp licenses, 1931	30 00	
Market fishermen's licenses, 1930-31	29,680 00	
Market fishermen's licenses, 1931-32	27,220 00	
Trapping licenses, 1930-31	2,860 00	
Wholesale fish packers' and shell fish dealers' licenses, 1930-31	1,125 00	
Wholesale fish packers' and shell fish dealers' licenses, 1929-30	5 00	
Total licenses sales		\$1,159,367 20
Other income:		
Contributions from importers	\$150 00	
Court fines	68,178 78	
Fish packers' tax	192,103 29	
Fish tag sales	2,817 37	
Game tag sales	104 28	
Interest on bank balances	5,861 72	
Kelp tax	152 78	
Miscellaneous sales	376 05	
Total other income		199,744 27
Total departmental income		\$1,359,111 47
Income for the State University Fund:		
Kelp tax	\$73 34	\$73 34

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1931

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Anchovies							66,335	50	14,435
Barracuda								3	281
Bonito				3,402	376	5,820		48	172
Carp				256	62,553	22,343			
Catfish									
Cultus-cod	218,919	3,921					50,199	4,524	22,212
Eels							40		
Flounders	410	4,940			12	21	3,106	913	160
Grayfish							820		
Hake	250						4,725		
Halibut	264,584	1,500	131		3		1,281	1,726	1,691
Hardhead							2,385		
Herring							2,604		20,577
Kingfish								4,347	378,835
Mackerel								4,491	10,544
Mackerel—Horse									
Mullet									
Pike	1,806								
Pike				4	48	113	3,192	3,170	18,524
Pompano							20	20	154
Rock Bass									
Rockfish	83,626	2,798					210,288	196,107	410,119
Sablefish	166,318	1,420					7,425	31,411	3,721
Salmon	717,164	301,849		61,966	135,393	223,983	12,340	9,830	20,400
Sandals	6,443	2,080					44,146	708	3,546
Sardines							773,615	12,870	225,455
Sardines							400	105	
Sea Bass—Black									
Sea Bass—White							44	679	170
Shad				19	345	736	95,491		
Shad—Buck				10,041	17,288	89,366			
Shad—Roe				80,269	42,995	439,457	95		

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1931—Continued
Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into California via San Pedro	Fish from south of the International Boundary brought into California via San Diego	Total fish from south of the International Boundary brought into California.
Anchovies		18,176	570	504,585	99,566	59,980	26,891	86,871
Barracuda	1,506	1,189,792	17,531	25,601	1,713,698	21,402	270	21,672
Bonito	27	83,125	4,906		113,879			
Carp		2,500			12,107			
Crab					85,152			
Calfish		40	35		299,850			
Cutlass-cod		100			140			
Eels		80	28		9,658			
Flounders		60,194	37,819	57,000	155,000			
Grayfish	55	285			5,260			
Hake		100,659	7,005	23,887	496,883		12,579	12,579
Halibut	94,419				3			
Hardhead								
Herring	18	73,506	657	622	2,385			
Kingfish	36,147	2,010,488	24,535	49,885	102,331			
Mackerel		16,430			2,504,371			
Mackerel—Horse		1,710	505	2,581	26,974	3,865		3,865
Mullet		13,014	68	290	51,976			
Perch	2,462				165			
Pike		1,030	22	588	1,834			
Pompano		82,322	28,338	70,549	186,805	4,764	2,533	7,297
Rock Bass	5,596				2,073,163			
Rockfish	18,975	872,954	7,228	271,088	212,728			
Sablefish		2,155	278		1,482,425			
Salmon					59,846			
Sandbars		2,399	524		1,071,006			
Sardines	35	29,703	1,160	28,768	24,455			
Soulin		21,519	916	1,515	71,359	9,049	35,920	44,969
Sea Bass—Black	1,084	9,754	13,532	46,989	176,094	4,475	36,897	41,372
Sea Bass—White	10,665	133,525	1,994	29,017	96,591			
Shad					116,675			
Shad—Buck					568,816			
Shad—Roe								

	442	30,223 7,231	106 446	1,251	32,022 20,277	105 291,580	105 535,179
Sheepshead							
Skates							
Skipjack							
Smelt	5,545	68,408	565	7,319	272,469	243,599	
Sole	72,896	13,359	875	19	1,553,097		
Split-tail					781		
Striped Bass					333,006		
Suckers					8		
Swordfish					58,757		
Tomcod		27,032		31,725	142		
Tuna—Bluefin		1,288,621		119	1,288,740	698,999	706,139
Tuna—Yellowfin						1,651,295	8,841,216
Turbot					11,598		
Whitebait					74,335		
White-fish		10,654	70	23,551	34,275	5,163	5,765
Yellow-tail	258	226,800	3,573	494,390	665,021	152,047	282,523
Miscellaneous	380	34,168	441	423	39,187	15,771	20,279
Total fish	250,510	6,431,956	153,727	1,611,762	16,211,206	2,870,409	10,609,831
Crustaceans:							
Crabs					4814,320		
Shrimps					472,546		
Spiny Lobsters						2,925	54,654
Mollusks:							
Alalones							
Clams—Cockle	22,297	6,571			1,080,197		
Clams—Mixed		3,138			36,692		
Clams—Pismo	25,844				4,643		
Clams—Softshell					26,864		
Cuttlefish		69	2		28,696		
Mussels					28,844		
Oysters—Eastern					200		
Oysters—Native					492,178		
Squid		220			37,434		
Miscellaneous:					1,035,258		
Turtles							3,931
Totals	298,651	6,441,954	153,729	1,611,762	19,869,078	2,873,334	10,608,416

1 33,930 dozen.

2 418,990 shell oysters.

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